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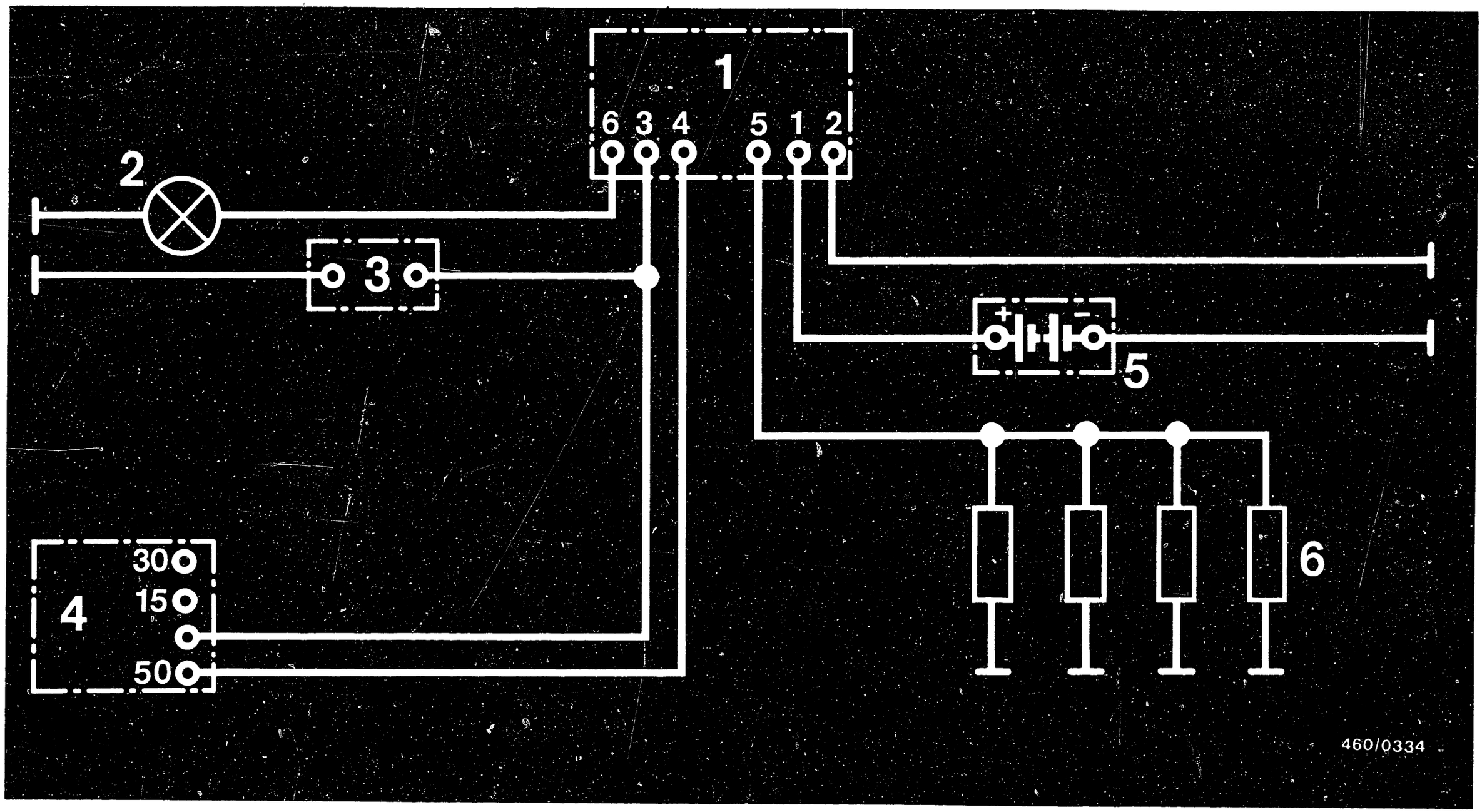
1. Test specifications

1.1 Idle speed:	750 ± 25 min^{-1}
1.2 Nozzle-opening pressure:	125 + 8 bar
1.3 Injection timing Engine position: Cyl. 1 at TDC Pump position: 0.82 mm ABDC	

1.4 Tightening torques

Injection-pump fastening screws	29 Nm
Fuel lines	25 Nm
Injection-pump gear	49 Nm
Camshaft gear	118 Nm
Nozzle-holder assemblies	78 Nm
Toothed-belt tensioner fastening nut	56 Nm



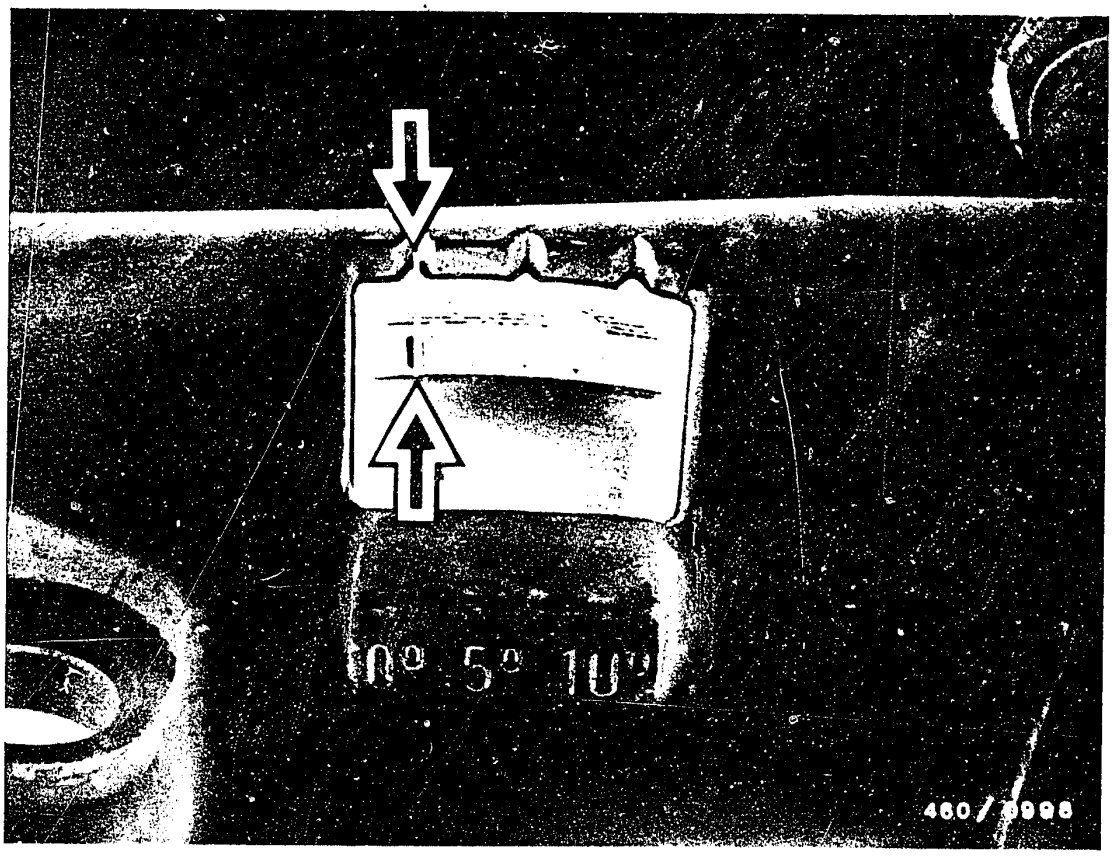
2. Terminal diagram for preheating system

1 = Glow-duration relay
2 = Visual indicator
3 = Solenoid-operated valve
4 = Glow-plug and starter switch
5 = Battery
6 = Sheathed-element glow plugs

3. Test equipment and tools

Designation	Part Number	Use
Measuring tool	KDEP 1085	Injection timing
Mini dial indicator 1/100 mm divisions	commercially available e.g. Hahn & Kolb 7000 Stuttgart Part No. 33033 with	Injection timing
Adapter for measuring tool	KDEP 1127	---
Puller	A. 42 129*	Removing injection-pump gear
Holding device	A. 60 473*	Locking injection-pump gear
Box wrench	A 65 090*	Loosening injection pump

* to be obtained from Fiat agent.



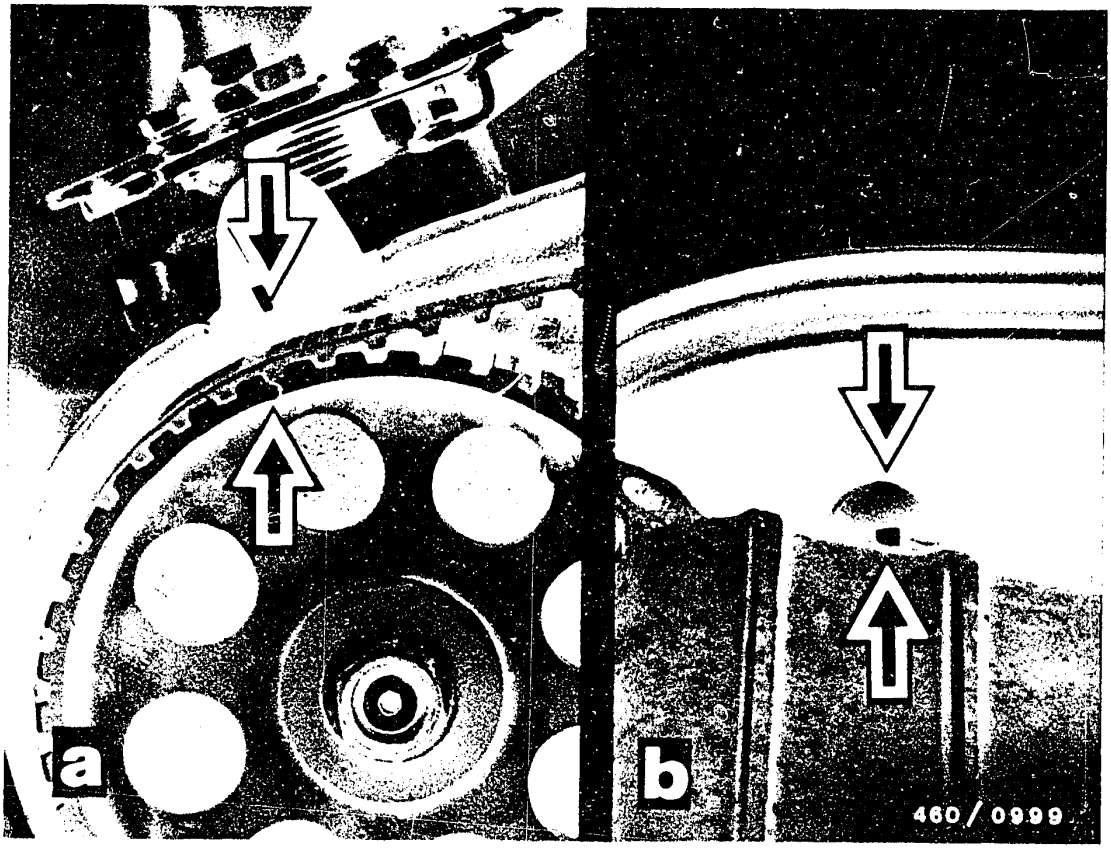
4. Remove fuel injection pump

Disconnect negative cable from battery.

Remove sound-insulation cover and toothed-belt guard.

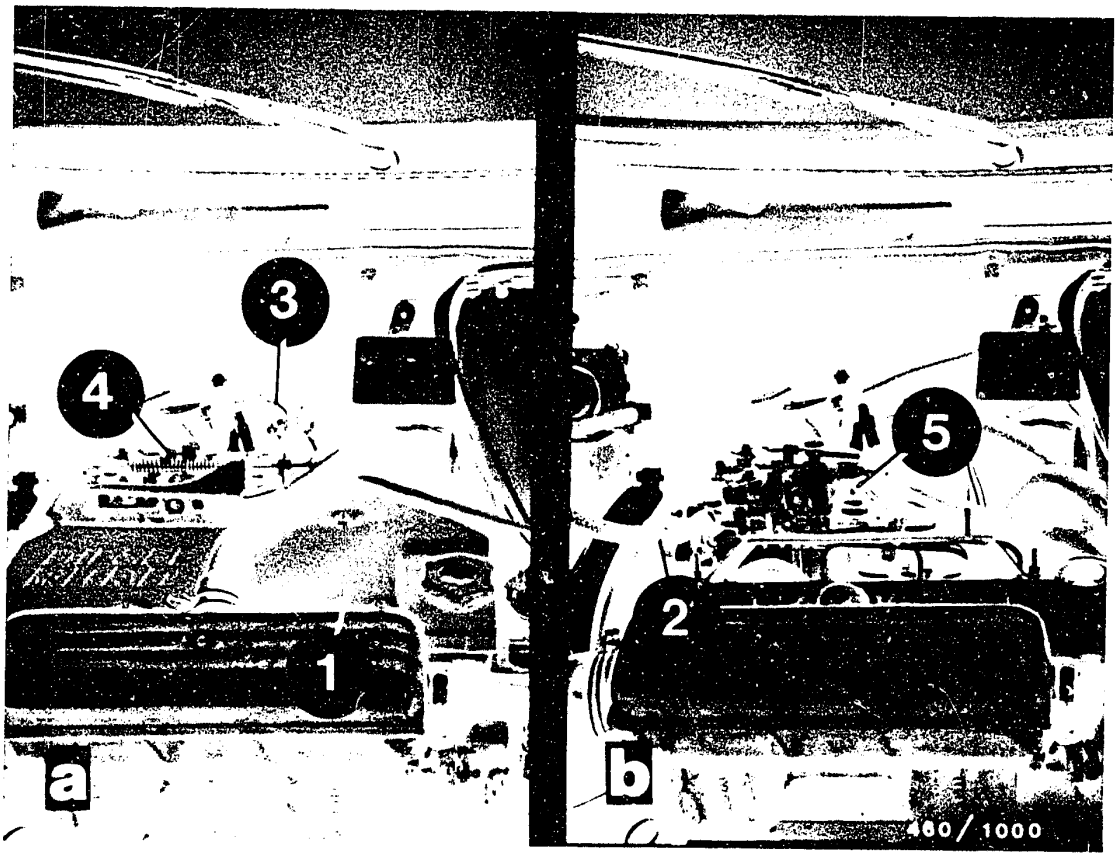
Turn crankshaft to TDC on cylinder 1.

The TDC mark on the flywheel must align with the reference mark (picture).



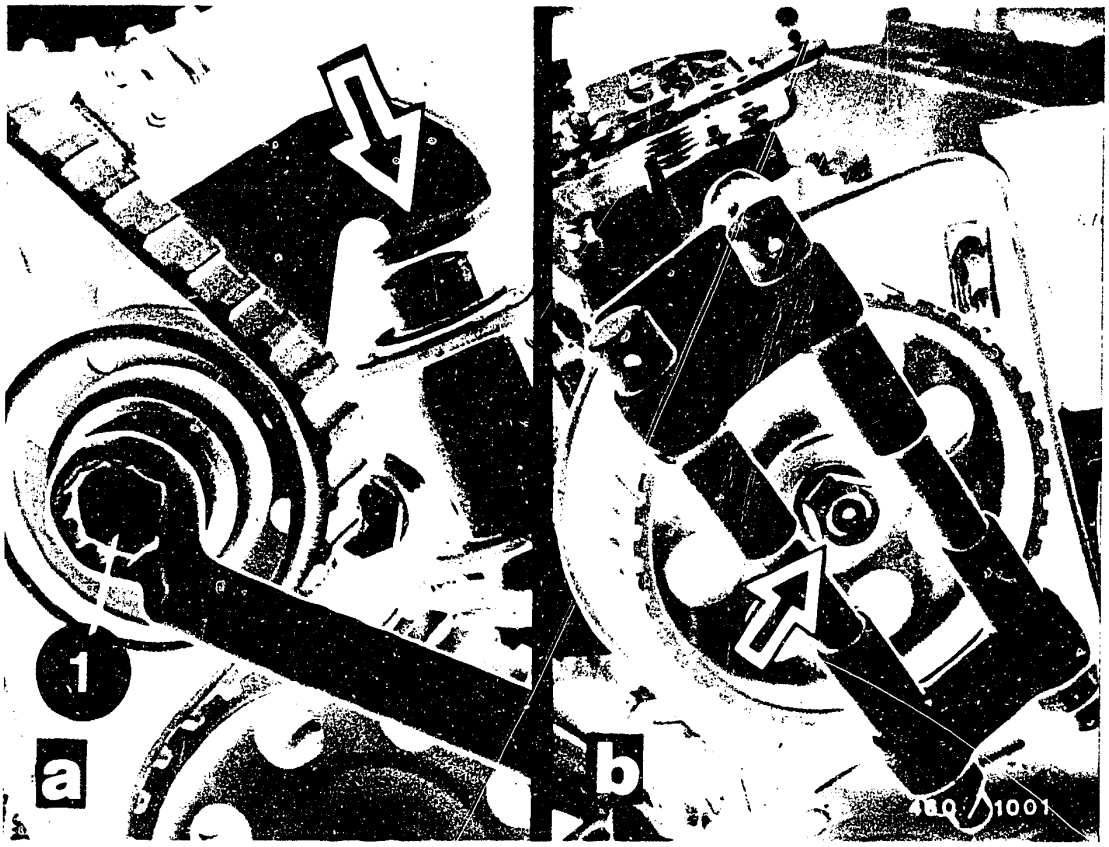
The mark on the pump drive gear points to the fixed mark on the toothed-belt protective cover (picture a).

The reference bore of the camshaft gear points to the fixed mark on the cylinder head (picture b).



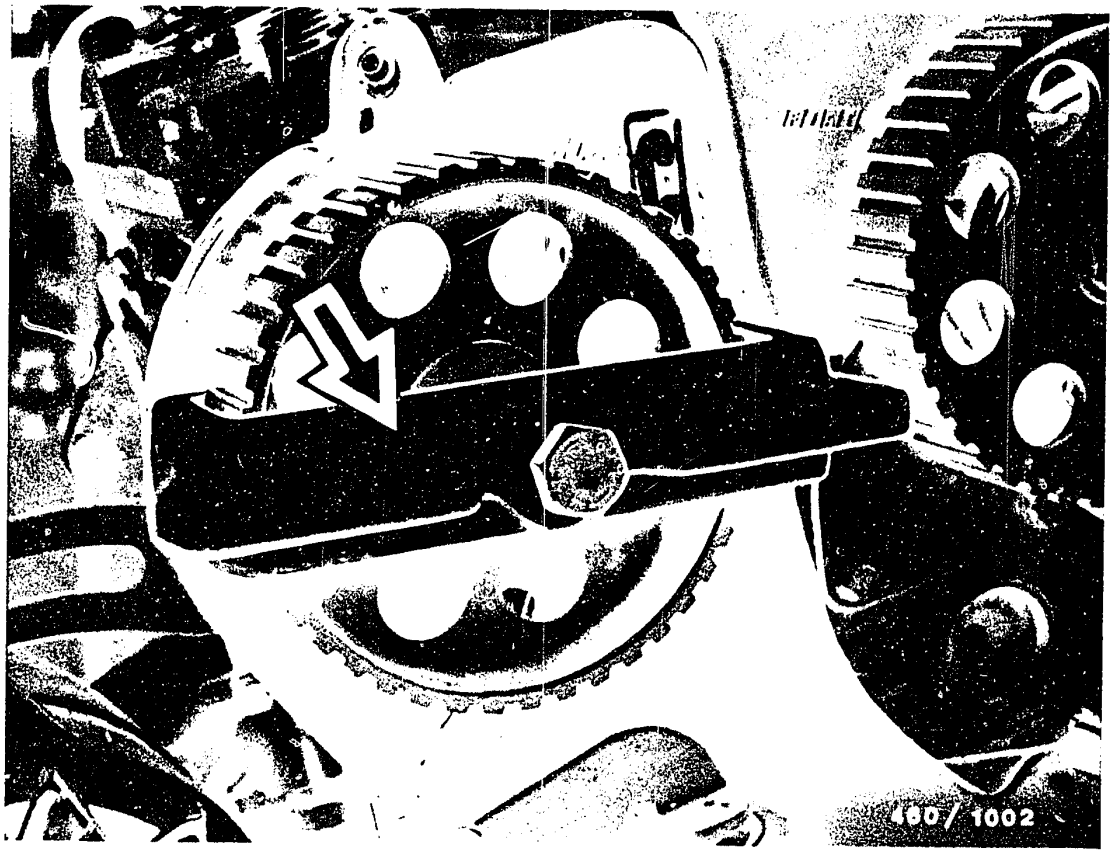
Remove sound-insulation cover (1).
Remove fuel inlet line (2), fuel return line (3), cable (4) from control lever.

Remove electric lead (5) from shutoff solenoids and injection lines.



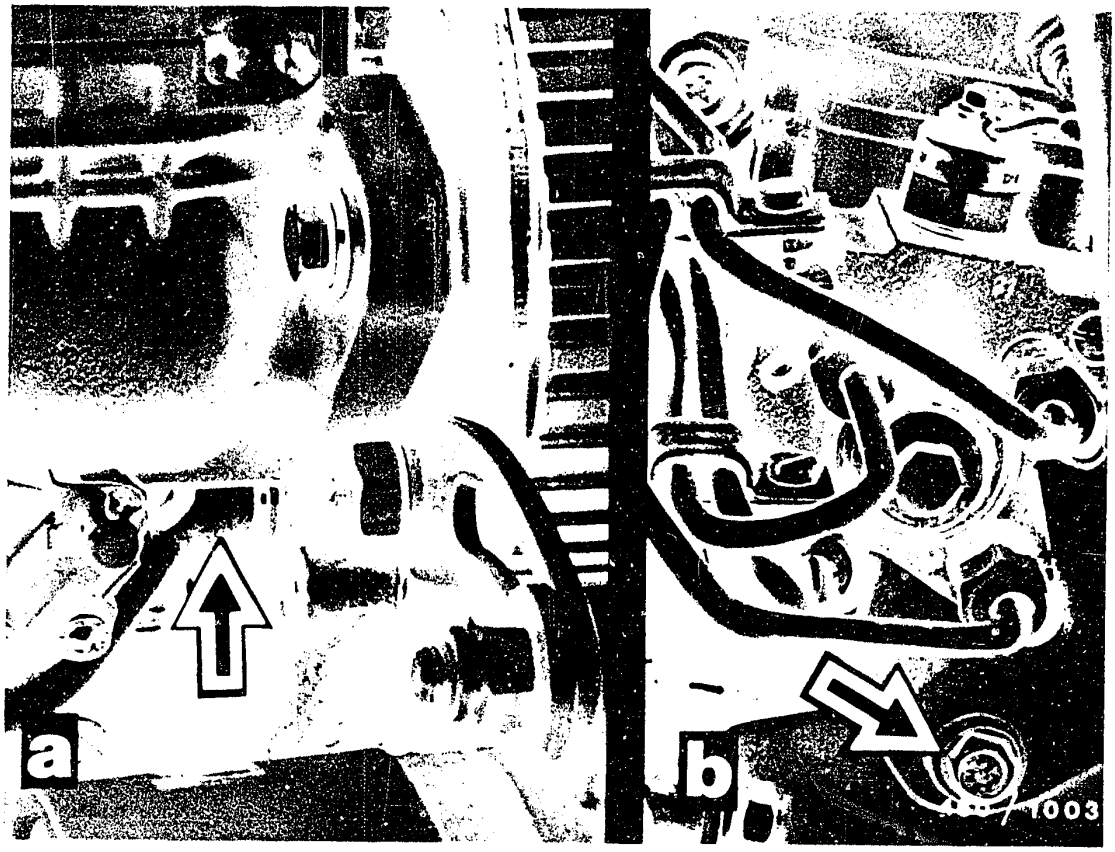
Loosen fastening screw of belt tensioning roller (1).
Press belt tensioning roller in direction of arrow against the spring force of the belt tensioner (picture a).
Remove toothed belt from camshaft gear.
Mount holding device A 60 473 on injection-pump drive gear (picture b).

Loosen fastening nut of injection-pump gear and unscrew by approx 2 turns.



Remove holding device A 60 473 from injection-pump gear.
Mount puller A 42 129 (arrow) on pump drive gear.
Pull off pump drive gear.

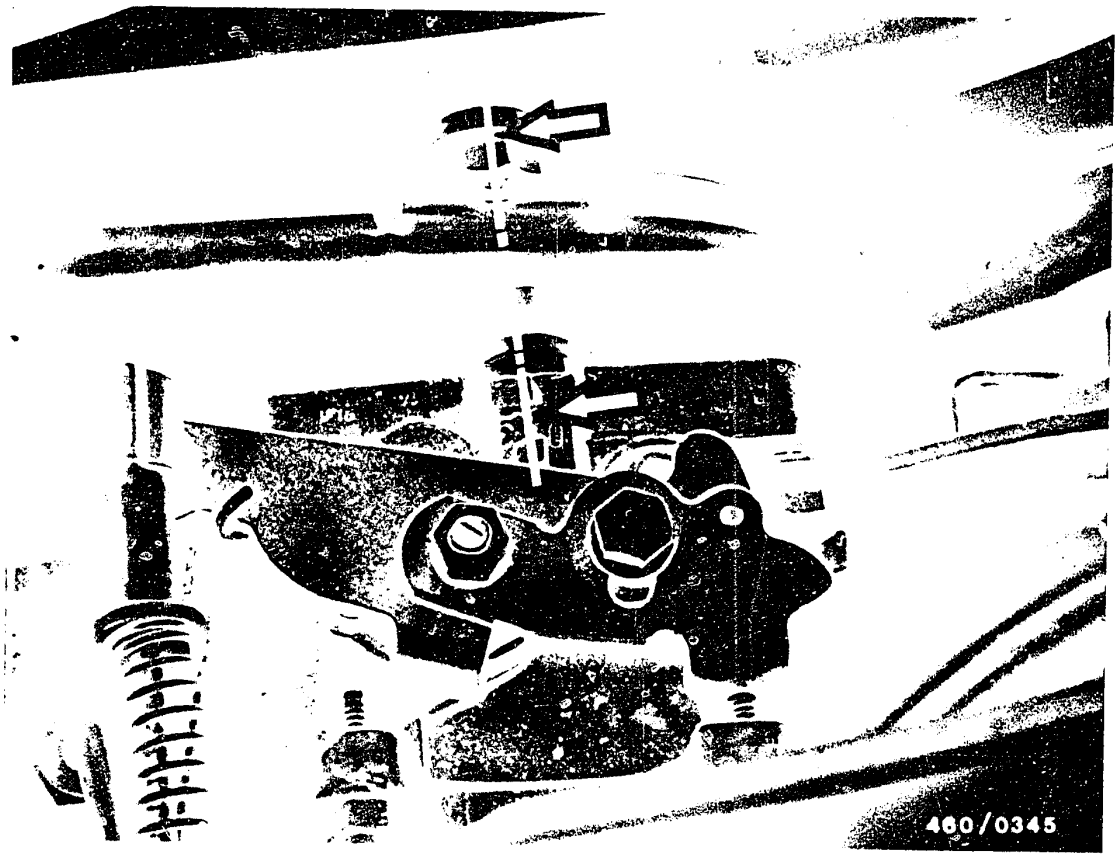
Remove puller.
Unscrew fastening nut and take off injection-pump gear.



Remove fastening screws (3 pieces) of injection pump.

Note:
Remove the bottom fastening screw of the injection pump with box wrench A.65 090 (arrow - picture a).

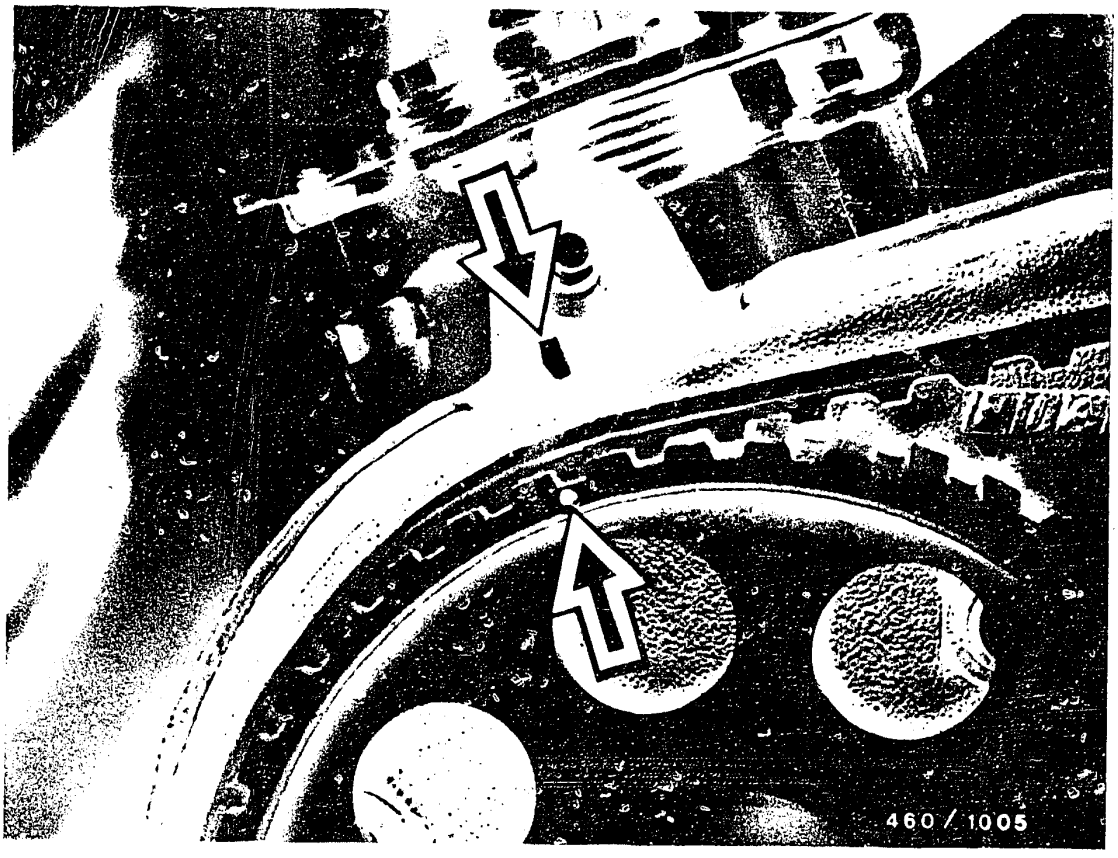
Remove fastening screw on support bracket of hydraulic head (picture b).
Remove injection pump from engine.



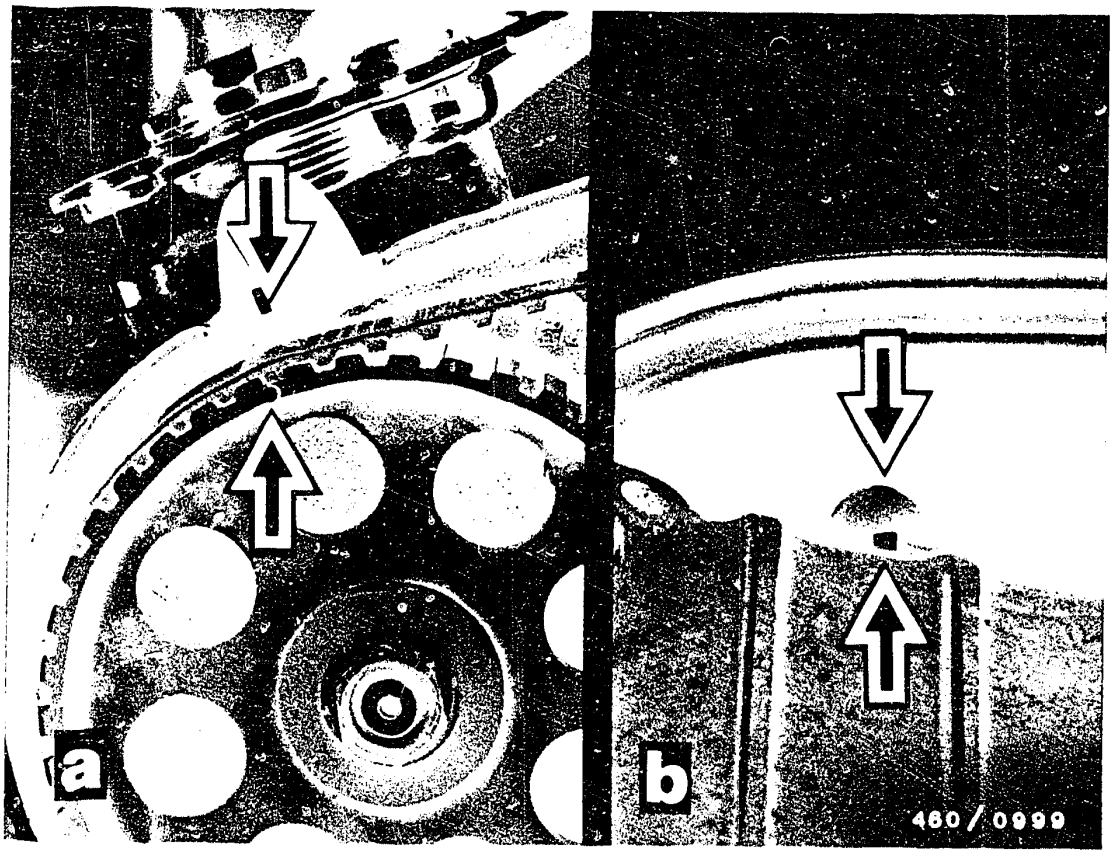
5. Install fuel-injection pump

Introduce fuel-injection pump so that the mark on the governor shaft and the tapped hole on the cover plate are in alignment.

Mount fastening screws of injection pump and finger-tighten.

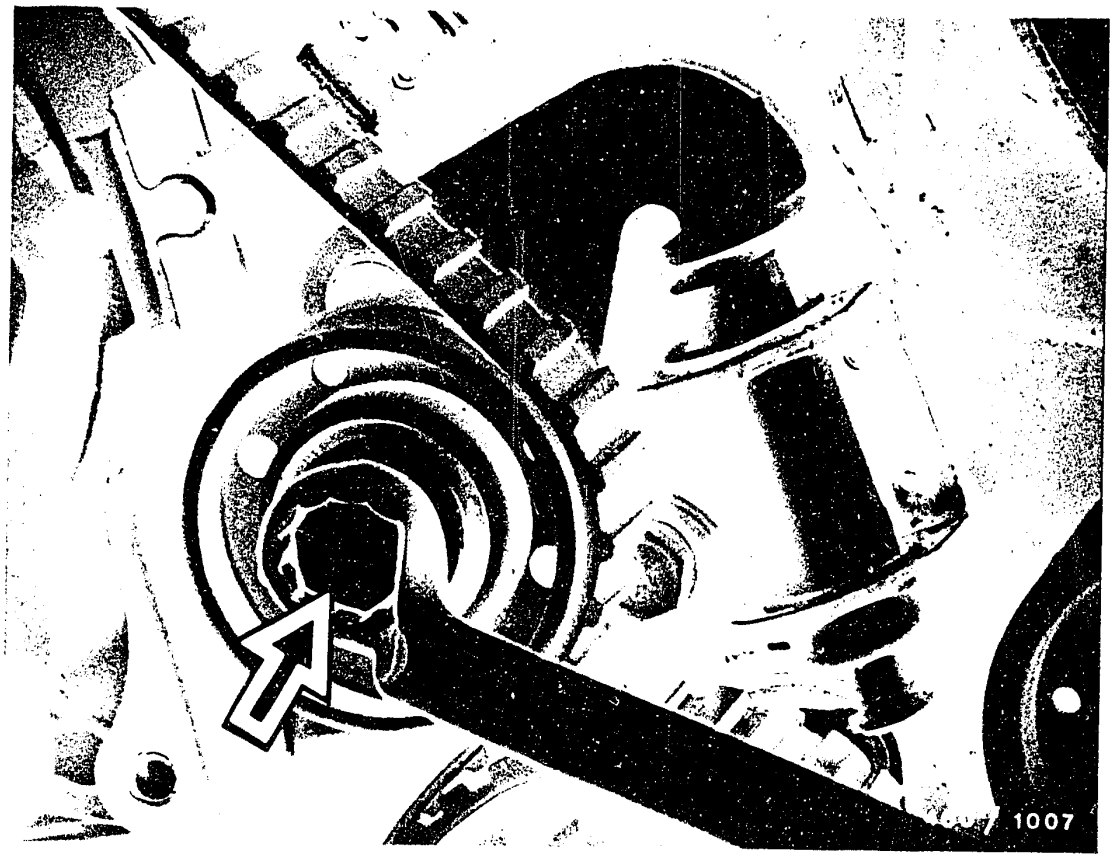


Mount injection-pump gear (woodruff key in cone of pump drive shaft must be installed) and turn so that the mark on the injection-pump gear points to the fixed mark on the toothed-belt protective cover (arrows).
Screw on fastening nut of injection-pump gear with retainer. Mount holding device A. 60 473. Tighten hexagon nut on injection-pump gear to 49 Nm.



Place new toothed belt on injection-pump gear and camshaft gear.
The marks on the camshaft gear (b) and on the injection-pump gear (a) point to their reference points.

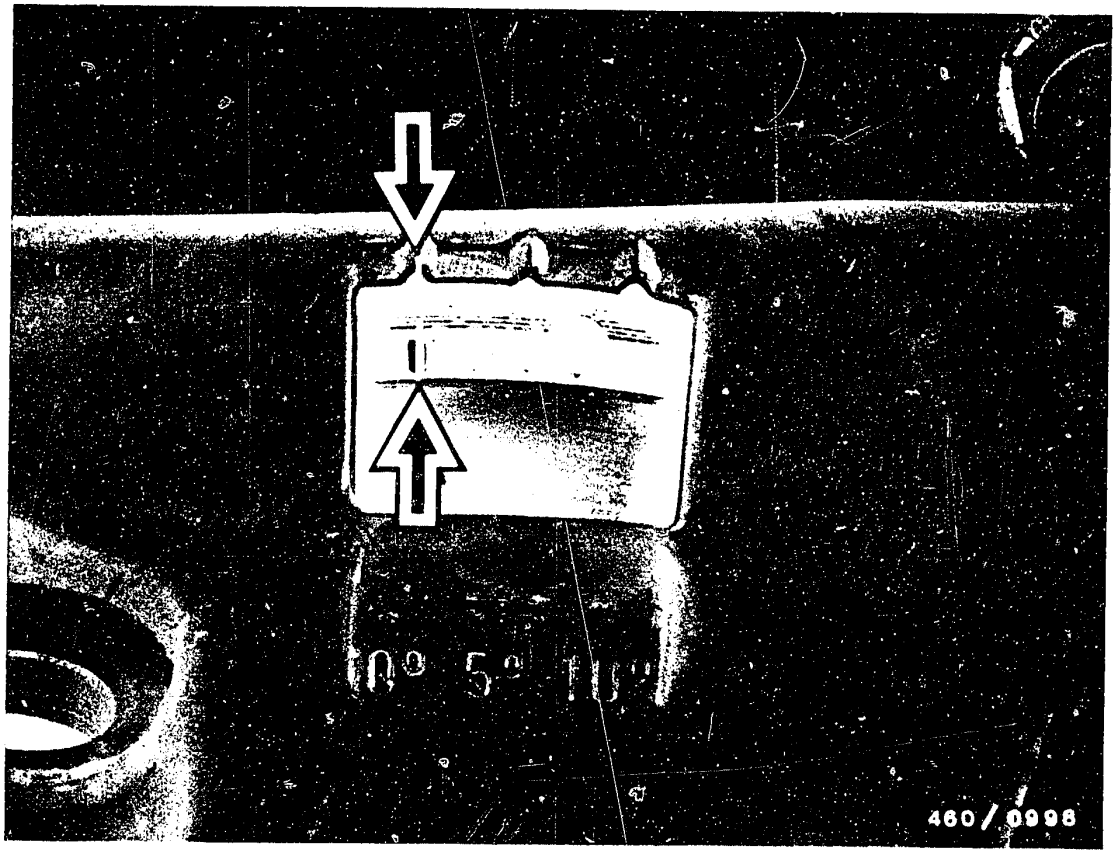
Caution
Whenever work on the injection pump involves loosening the toothed belt, fit a new toothed belt.



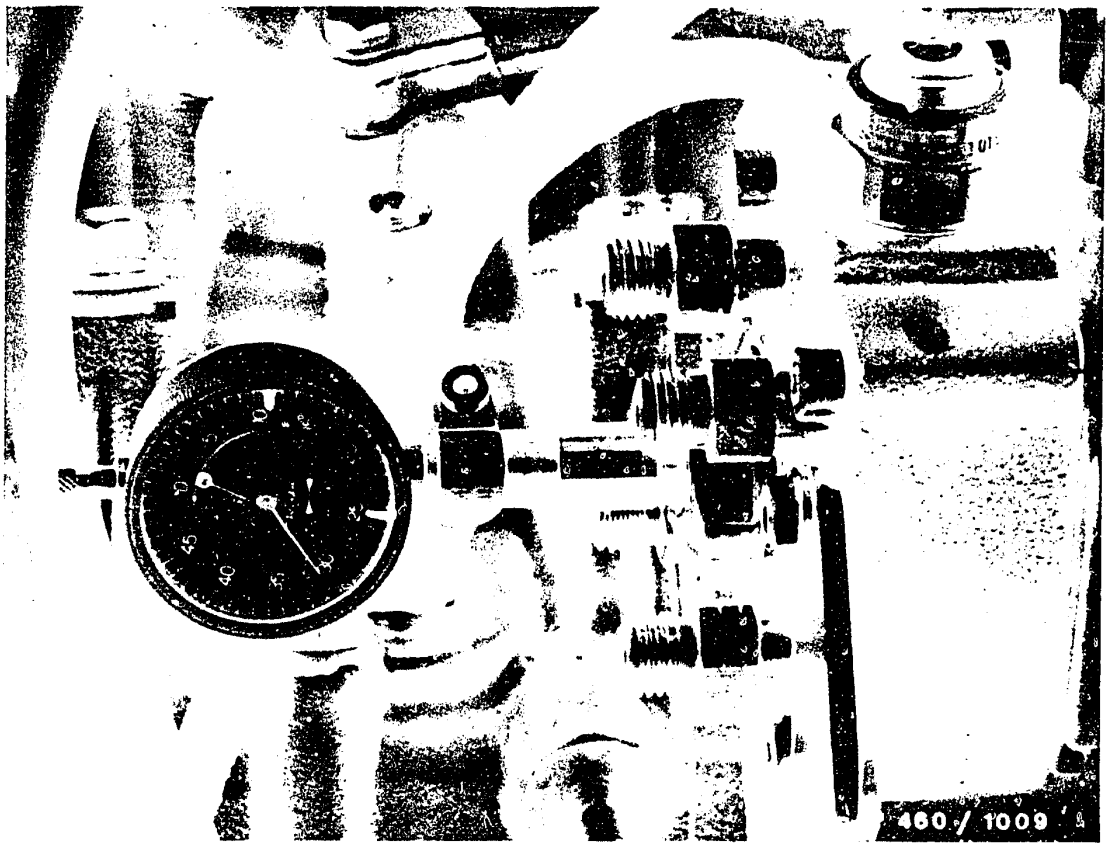
Loosen fastening screw (arrow) of belt tensioning roller until spring-loaded belt tensioner presses against toothed belt.

Re-tighten fastening screw. Turn engine over two full times in engine direction of rotation until the marks on camshaft gear, injection-pump gear and TDC mark on fly-wheel align with the reference points.

Loosen fastening screw of belt tensioning roller until spring-loaded belt tensioner presses against toothed belt. Tighten fastening screw to 57 Nm.



The TDC mark on the flywheel must align with the reference mark (arrow).

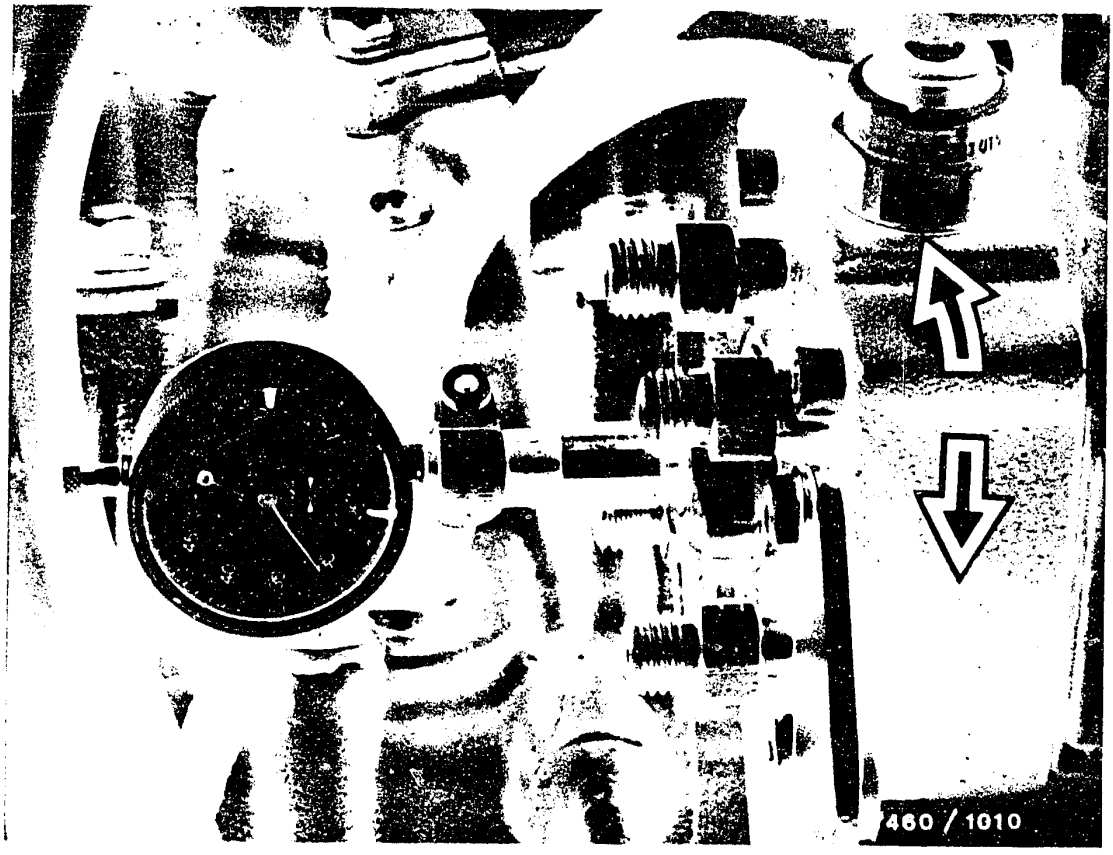


Unscrew bleeder screw out of central screw plug (triangular plug) of hydraulic head.

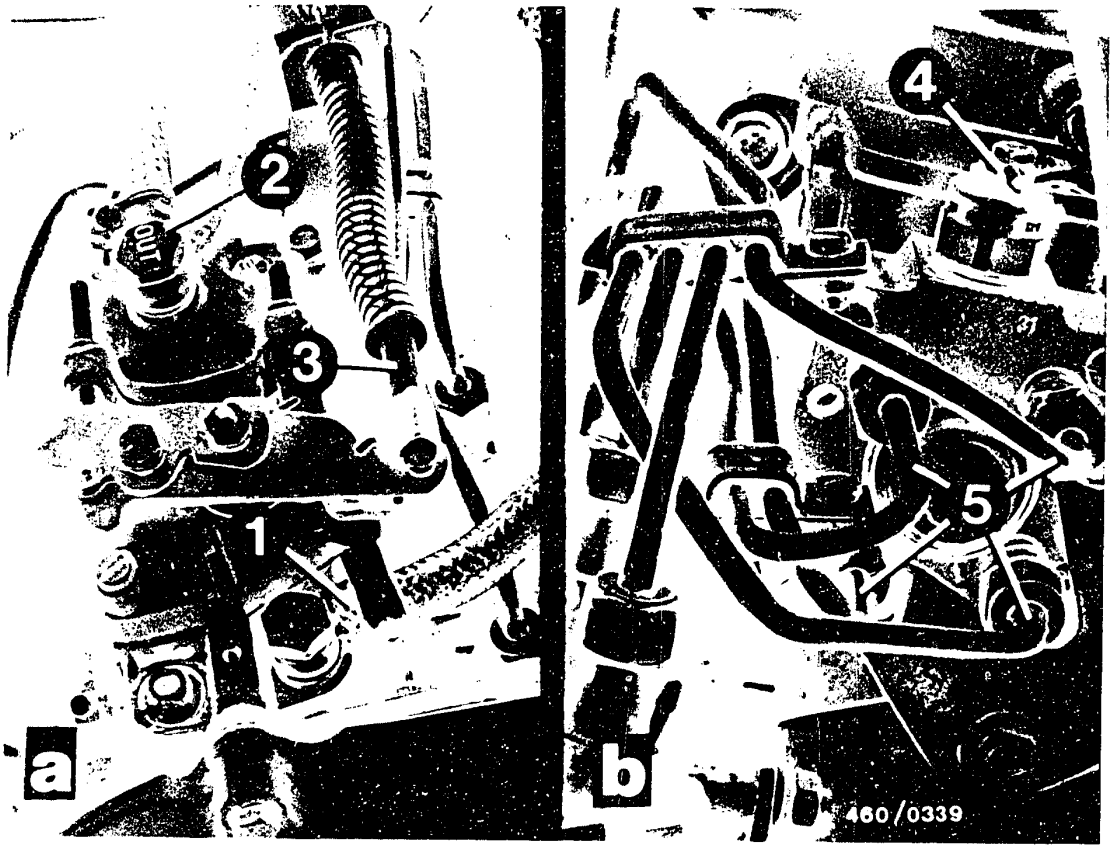
Mount measuring tool KDEP 1085 with dial indicator e.g. 1 687 233 011 in this bore and preload by approx 3 mm.

Turn engine against its direction of rotation until the pointer of the dial indicator no longer moves.
Preload dial indicator by approx 1 mm and set to "0".

Note:
Cold-start accelerator in zero position.



Turn engine in its direction of rotation until the marks on camshaft gear, injection-pump gear and TDC mark on the flywheel are in alignment (cylinder 1 at TDC).
In this position, the dial indicator must indicate a stroke of 0.82 mm.
If a correction is necessary, loosen injection-pump fastening screws. Pivot injection pump until a stroke of 0.82 mm is obtained. Tighten fastening screw to 29 Nm. Turn engine over twice and check adjustment.
Remove measuring tool KDEP 1085 with dial indicator.
Mount bleeder screw with new seal ring.



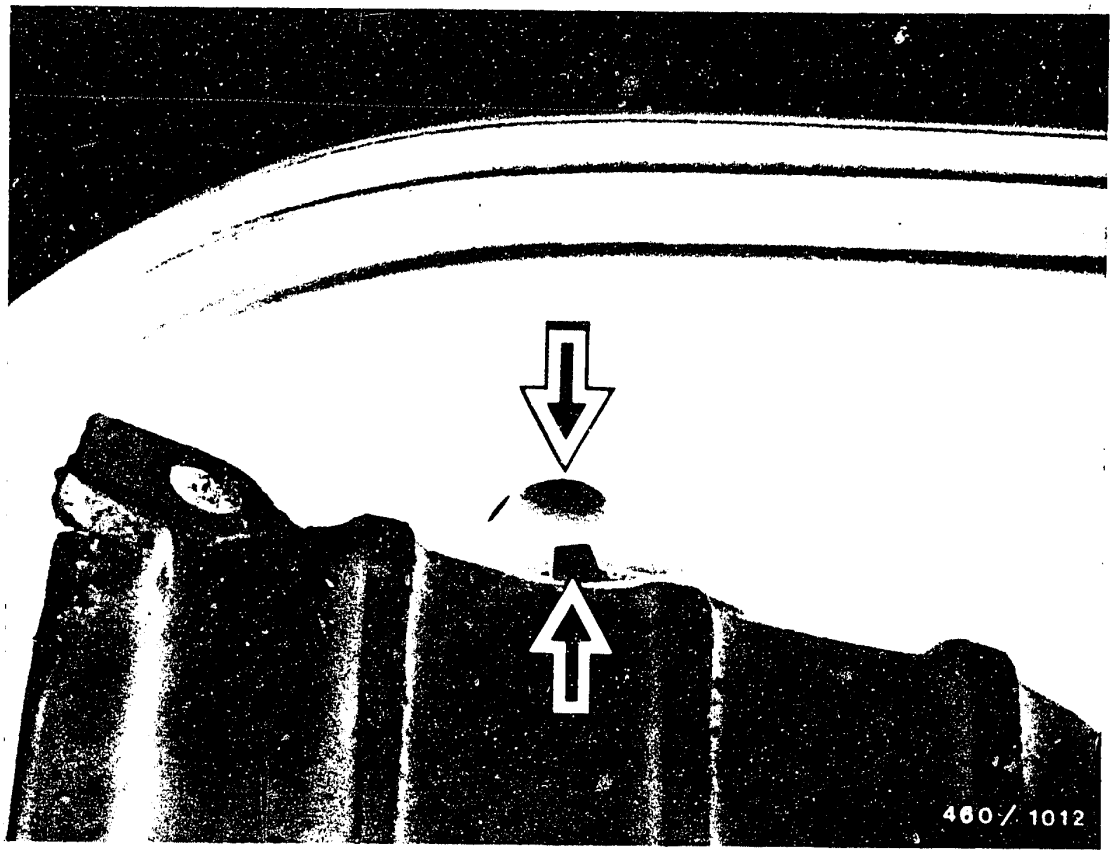
Mount fuel inlet line (1), fuel return line (2), cable on control lever (3), electric lead on shutoff solenoid (4) and injection lines (5) on injection pump.

Note:

The inlet-union screws of the fuel inlet and return lines must not be mixed up. The inlet-union screw of the return is provided with a restriction bore and the head of the screw is marked "OUT".

Mount engine timing cover. Connect negative cable to battery.

Bleed fuel-injection system.



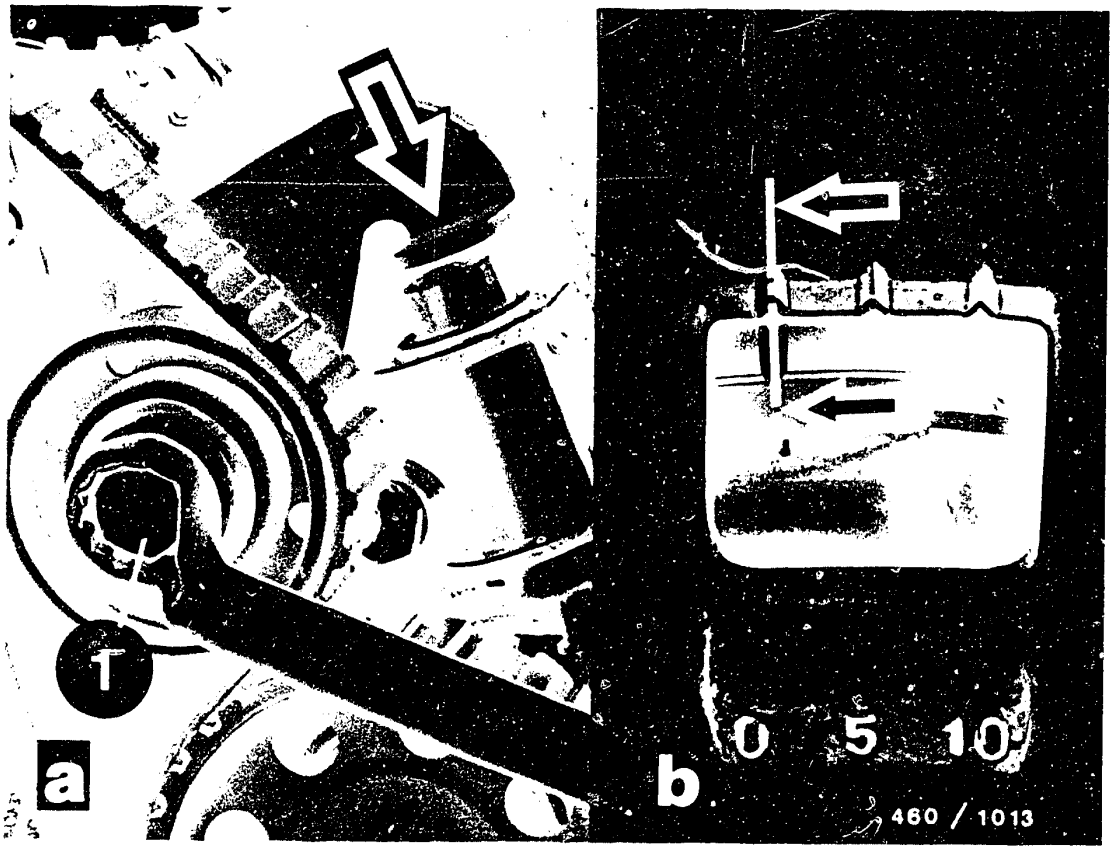
6. Check and adjust engine timing

6.1 Check engine timing

Remove toothed-belt protective cover.
Turn crankshaft in engine direction of rotation until reference bore on camshaft gear and fixed mark on cylinder head are in alignment.

The marks on flywheel (cyl. 1 at TDC) and housing must be in alignment.

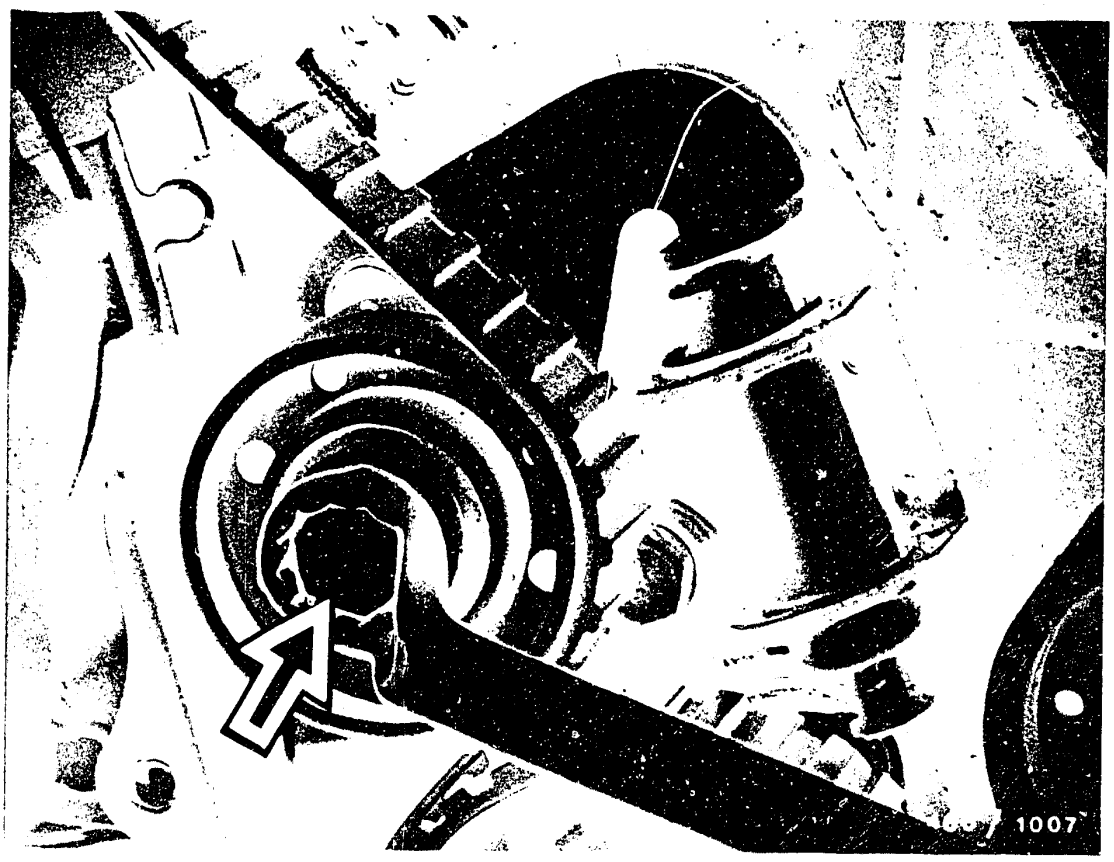
If the marks are not in alignment, it is necessary to adjust the engine timing.



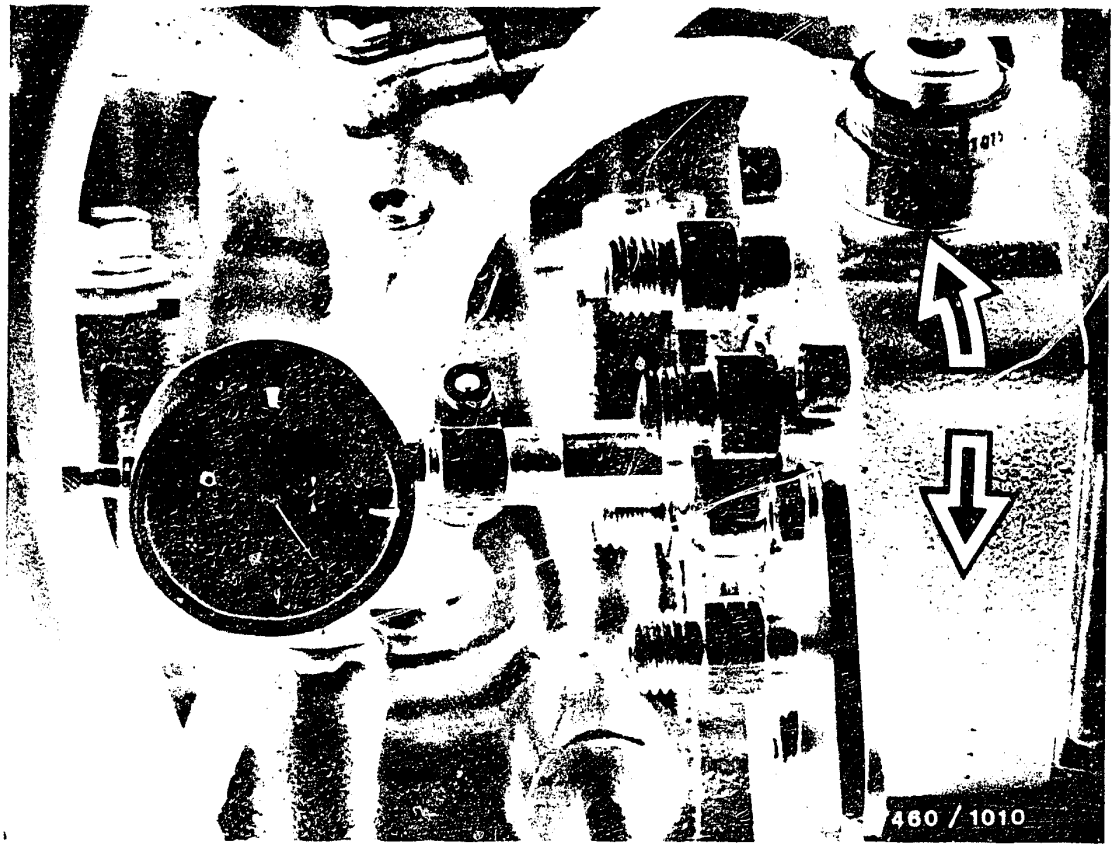
6.2 Adjust engine timing

Loosen fastening screw (1) of belt tensioning roller.
Press belt tensioning roller against spring force of belt tensioner (arrow, picture a) until toothed belt is loose.
Remove toothed belt from camshaft gear and injection-pump gear.

Turn crankshaft of engine until TDC mark on flywheel aligns with reference mark on cover plate (picture b).
Put on toothed belt.
Make sure that marks on camshaft gear and injection-pump gear point to the reference points.



Loosen fastening screw of belt tensioning roller until spring-loaded belt tensioner presses against toothed belt. Tighten fastening screw.
Turn crankshaft over two full times in engine direction of rotation and check engine timing.
Loosen fastening screw of belt tensioning roller until spring-loaded belt tensioner presses against toothed belt. Tighten fastening screw to 57 Nm.
Remove injection lines. Prevent delivery-valve holders from coming loose by holding with a wrench.
Remove bleeder screw.
Mount measuring tool KDEP 1085 and preload by 3 mm.



Turn crankshaft against engine direction of rotation until pointer of dial indicator no longer moves.
Turn crankshaft in engine direction of rotation until the marks on camshaft gear, injection-pump gear and crankshaft gear are in alignment.

In this position, the dial indicator must indicate a stroke of 0.82 mm.
Make corrections by pivoting the injection pump.
Turn crankshaft over twice and check adjustment.

Remove measuring tool KDEP 1085. Mount bleeder screw with new seal ring.
Mount injection lines and toothed-belt protective cover.

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1. Special features

The test specifications and setting values apply to the following vehicles:

Renault R 18 D-Turbo	4.84 →
Espace D-Turbo	10.84 →
Jeep Wagoneer/Cherokee D-Turbo	4.84 →

2. Test specifications

2.1 Idle speed	700...750 min^{-1}
2.2 Nozzle-opening pressure	130 + 8 bar
2.3 Injection timing	
Engine position:	1st cylinder at TDC
Check value: Pump position:	0.68...0.72 mm after BDC
Setting value: Pump position:	0.70 mm after BDC
2.4 Compression:	20...30 bar
2.5 Charge-air pressure:	0.6 bar ± 0.025

2.6 Toothed belt tension

Scale reading	14 ... 15

2.7 Tightening torques

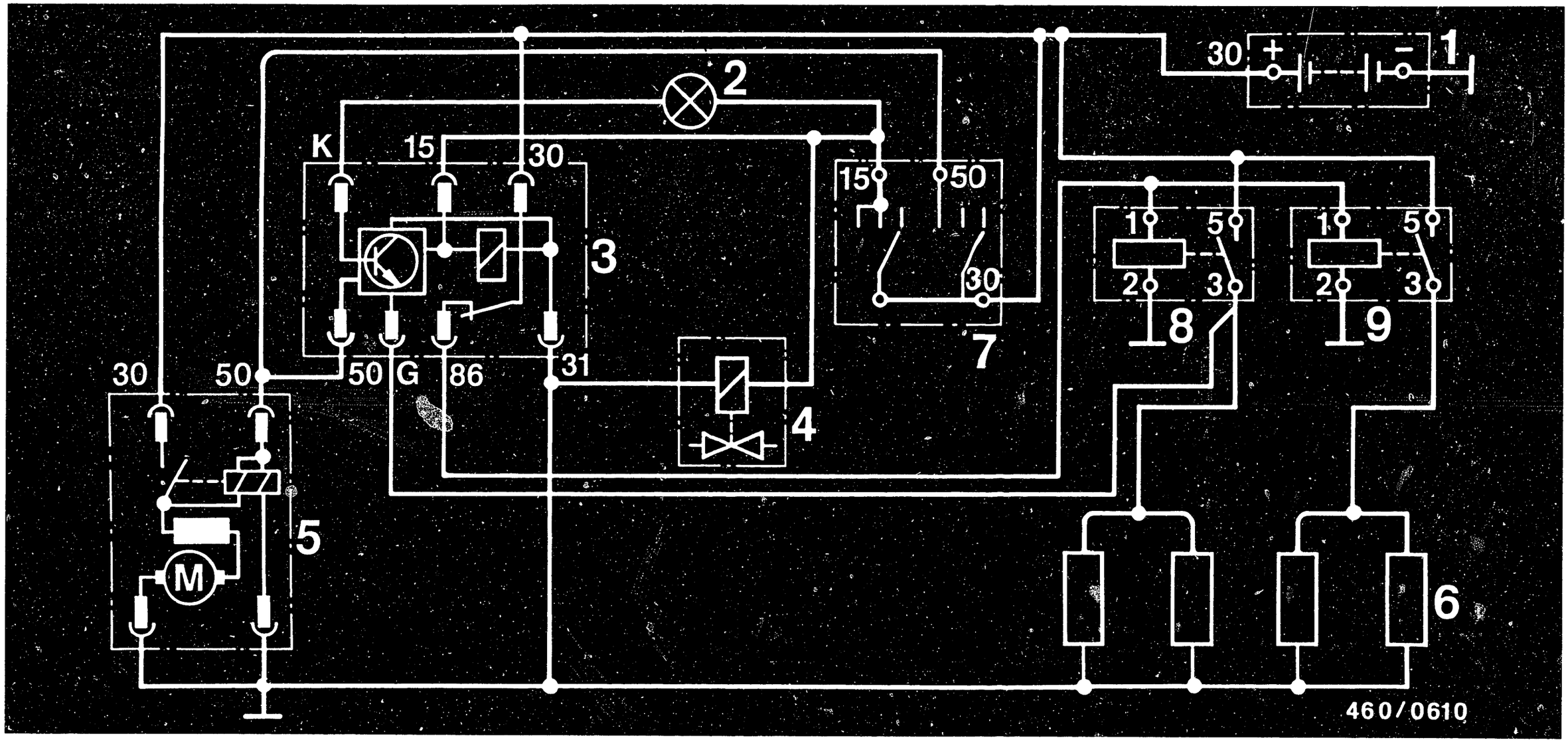
Fuel-injection pump fastening screws	25 Nm
Injection-pump gear (hexagon nut)	80 Nm
Nozzle-holder assembly	17 Nm
Fuel lines	25 Nm
Screw plug	10 Nm
Injection-pump support bracket (fastening screws)	25 Nm
Sheathed-element glow plugs	20 ... 30 Nm

Note:

The Diesel engine which is fitted is essentially the same as that fitted to the Renault R20/30 D-Turbo. Similar SIS repair instructions: Microcard REN-500.

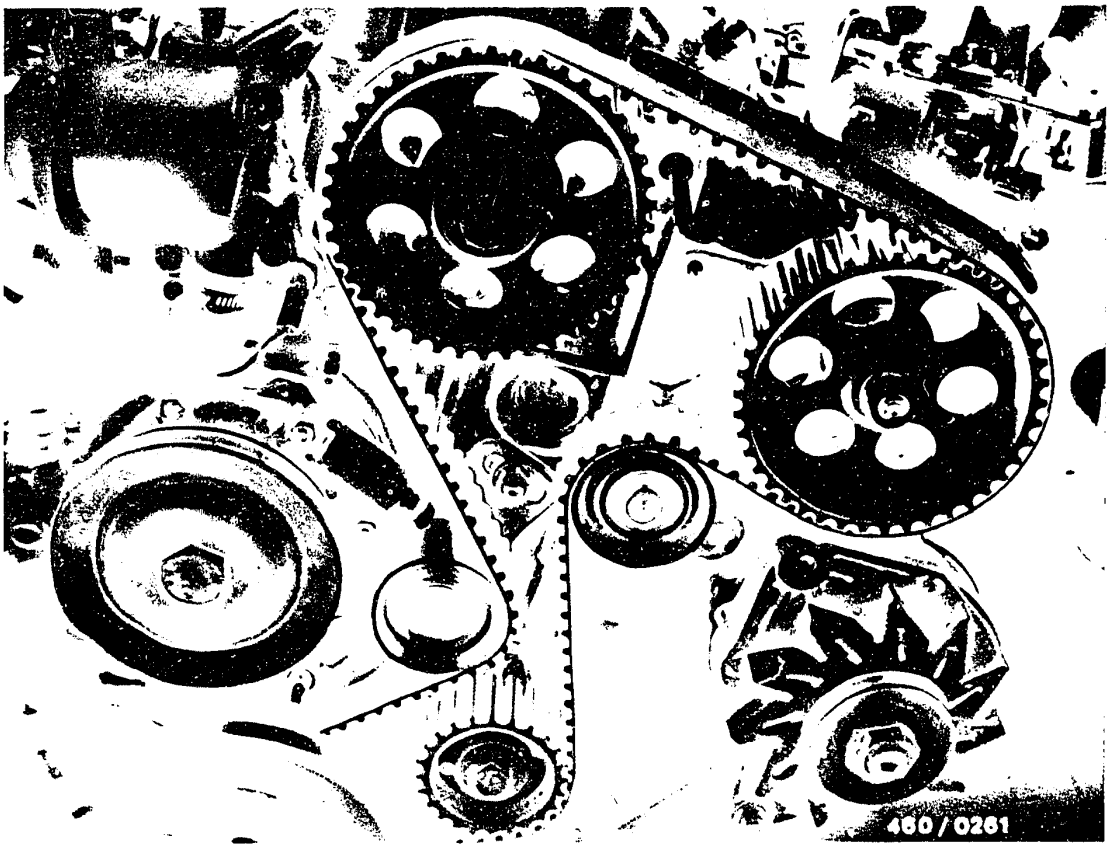
3. Test equipment and tools

Description	Part Number	Use
Puller	KDEP 1118*	Removing injection-pump gear
Setting mandrel	KDEP 1123	Locking crankshaft
Holding device	KDEP 1124	For locking the pump drive gear
Toothed-belt tester	KDEP 1121	Testing tension of toothed belt
Box wrench	KDEP 1115	Loosening/tightening injection lines
Pressure tester or pressure gauge 0 ... 1.6 bar	KDJE-P 100 e.g. Wika No. 4184	Testing charge-air pressure
Measuring tool	KDEP 1085	Injection timing
Mini dial indicator 1 / 100 mm divisions	Commercially available e.g. Hahn & Kolb 7000 Stuttgart Part No. 33 003 with adapter KDEP 1127	Injection timing
Connection nipple	6 220 103 225 Moto-Meter	Testing compression pressure



1 = Battery
2 = Glow-plug indicator lamp (12 V 2 W)
3 = Glow-duration unit
4 = Solenoid-operated valve
5 = Starting motor
6 = Sheathed-element glow plugs
7 = Glow-plug and starter switch
8 = Power relay
9 = Power relay

4. Terminal diagram of pre-heating system



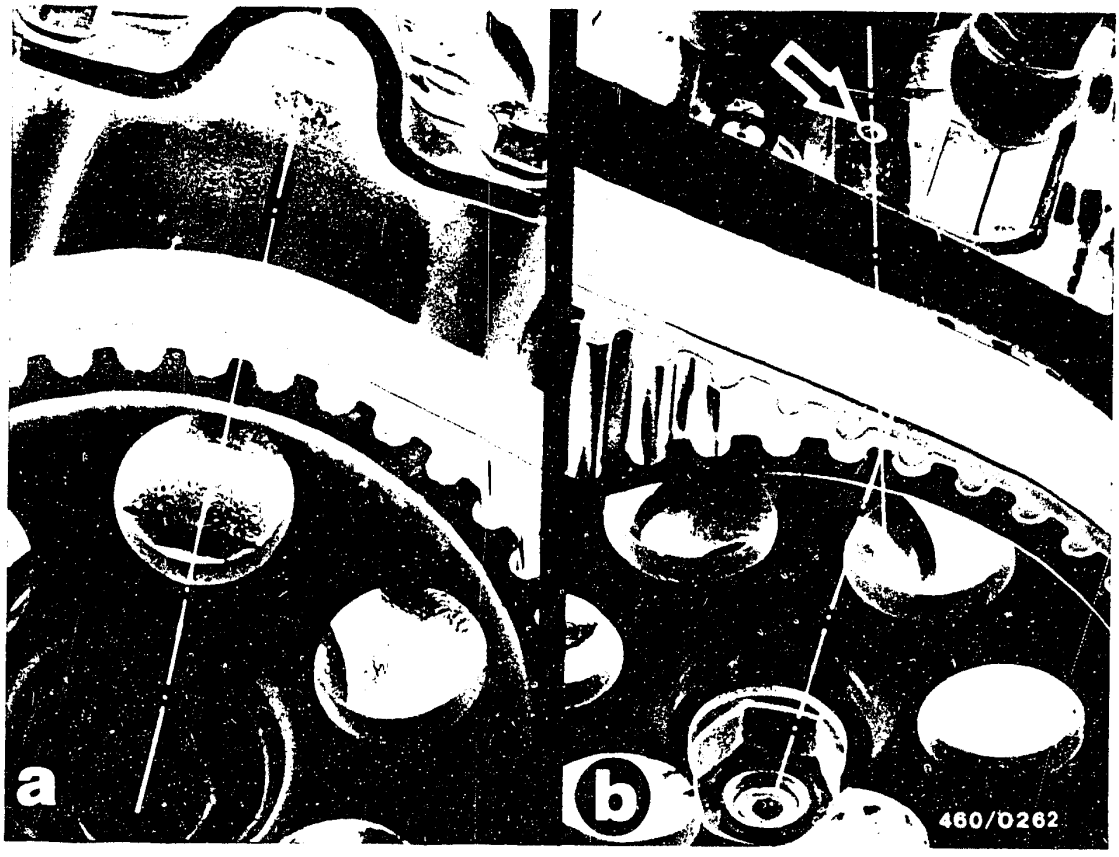
5. Removing the fuel-injection pump

Disconnect the negative lead from the battery.

Depending on the vehicle type, remove the front grille, lock plate or air baffle.
Remove the overflow hose from the radiator.

Lift the radiator and remove it from the engine compartment from the front.
Support the radiator from below.

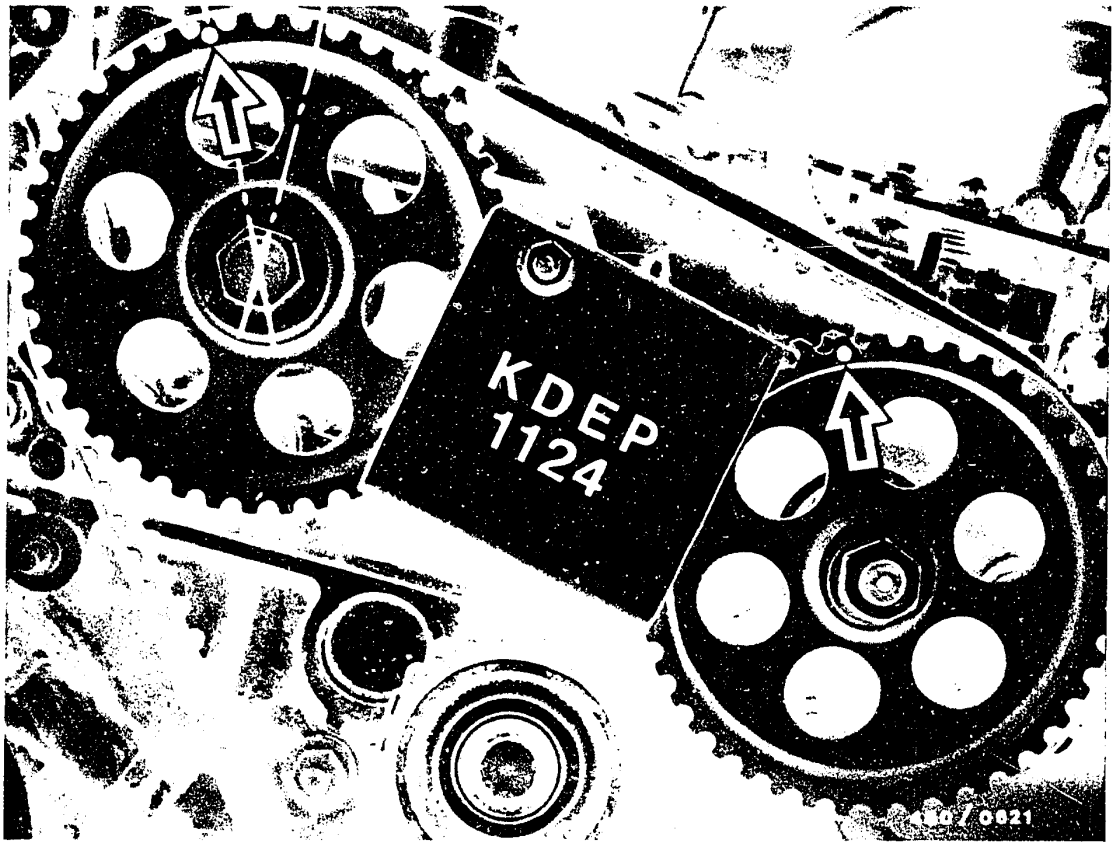
Remove the fan wheel.
Remove the V-belt from the alternator and power-assisted steering pump. Remove the cover of the toothed belt.



Turn the crankshaft until the 1st cylinder reaches TDC.

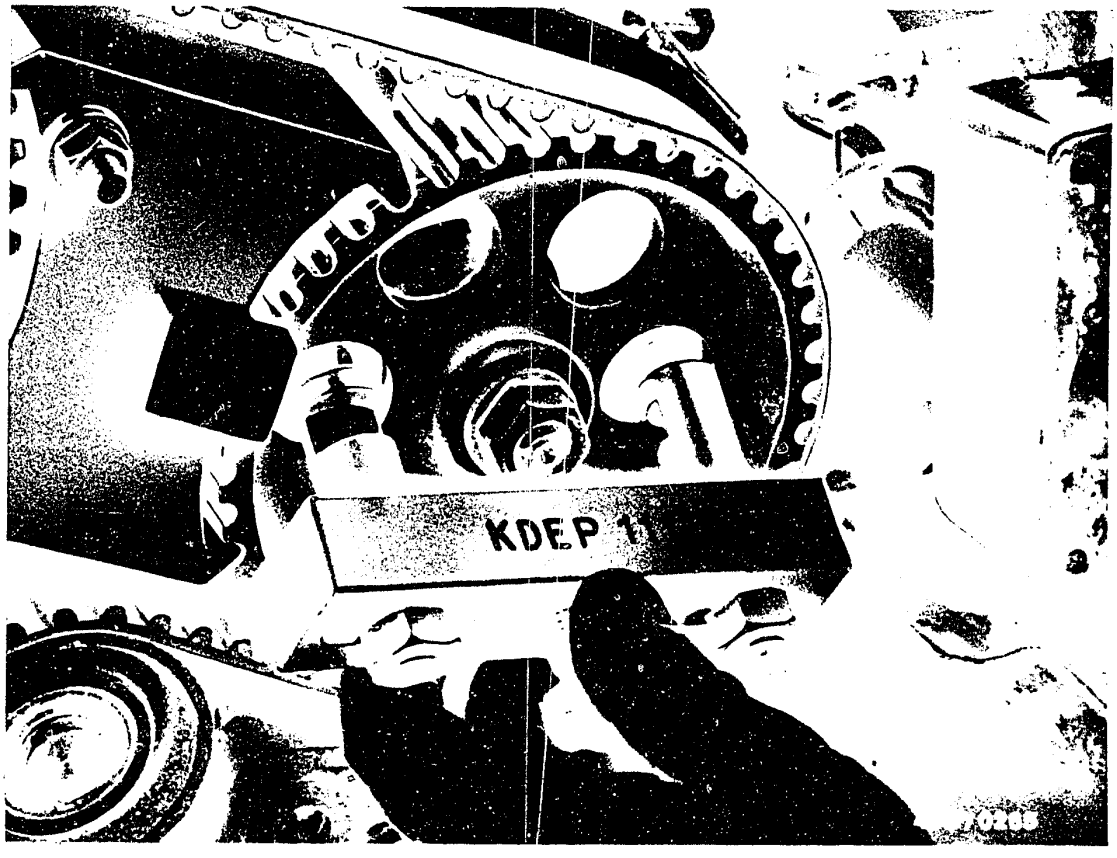
In this position, the mark on the camshaft gear aligns with the centre line of the valve cover (Fig. a).

Mark on pump drive gear therefore points to the centre line of the governor shaft bore (Fig. b).



Turn back crankshaft until the mark on the camshaft gear is three teeth before TDC mark on valve cover.

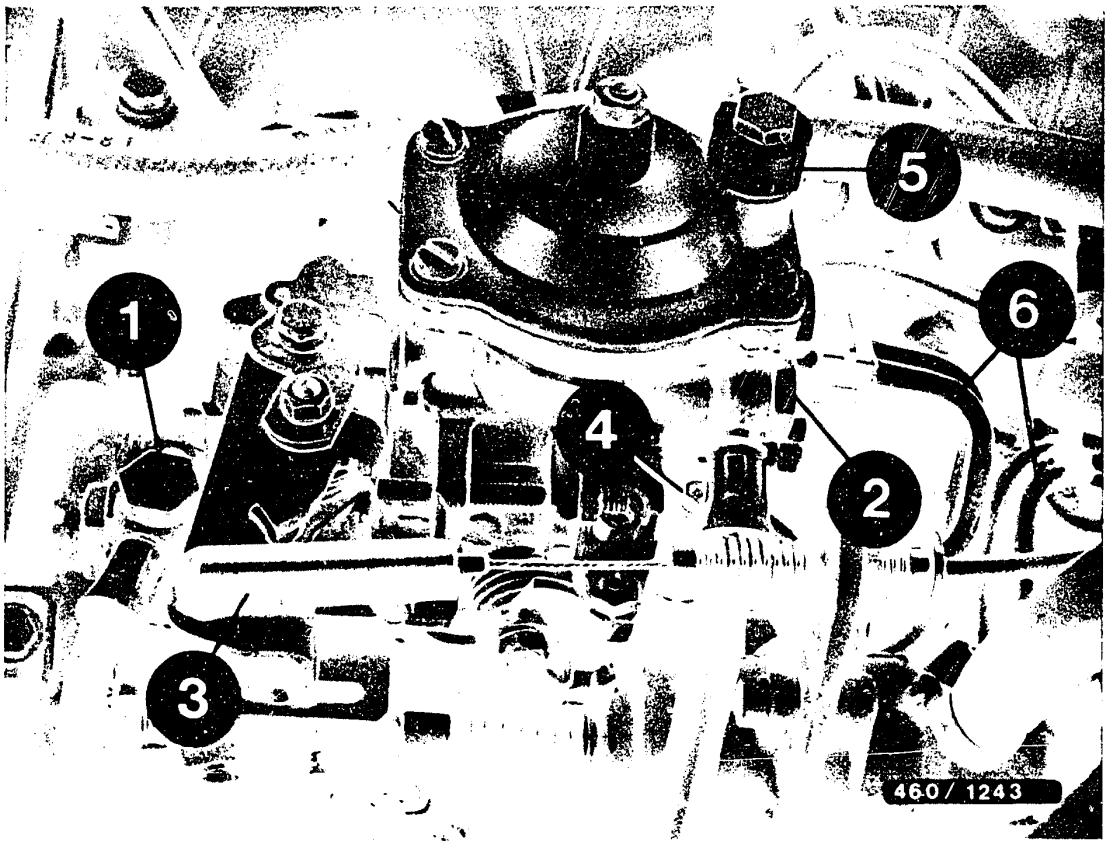
Insert holding device KDEP 1124 between camshaft gear and pump drive gear and secure.



Loosen injection-pump gear fastening nut and unscrew by approx. 2 turns.

Pull off injection-pump gear using puller KDEP 1118 (picture).

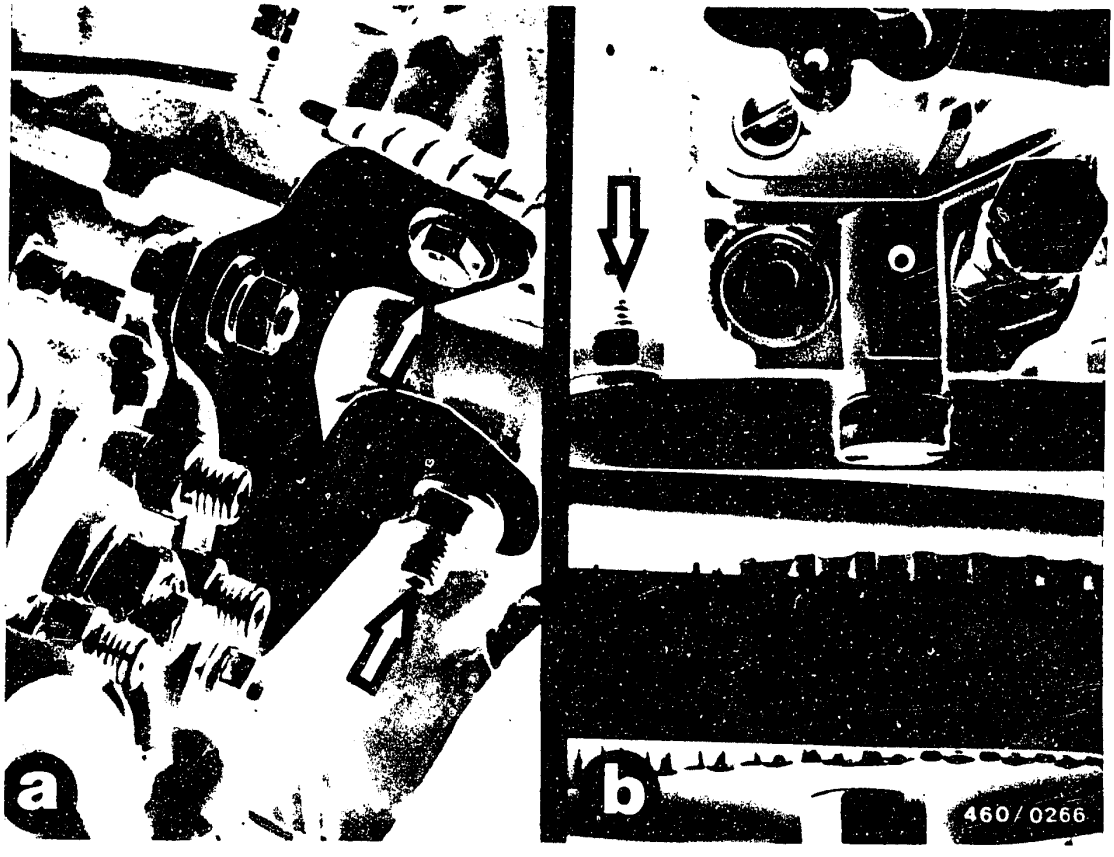
Remove fastening screw and plain washer from injection-pump drive shaft.



Remove the fuel inlet line (1), the return line (2), the control cable on the control lever (3), the lead for the electrical shut-off device (4), the charge-air-pressure connection (5) and the fuel-injection lines (6). (Steady the delivery-valve holders to prevent it from becoming detached).

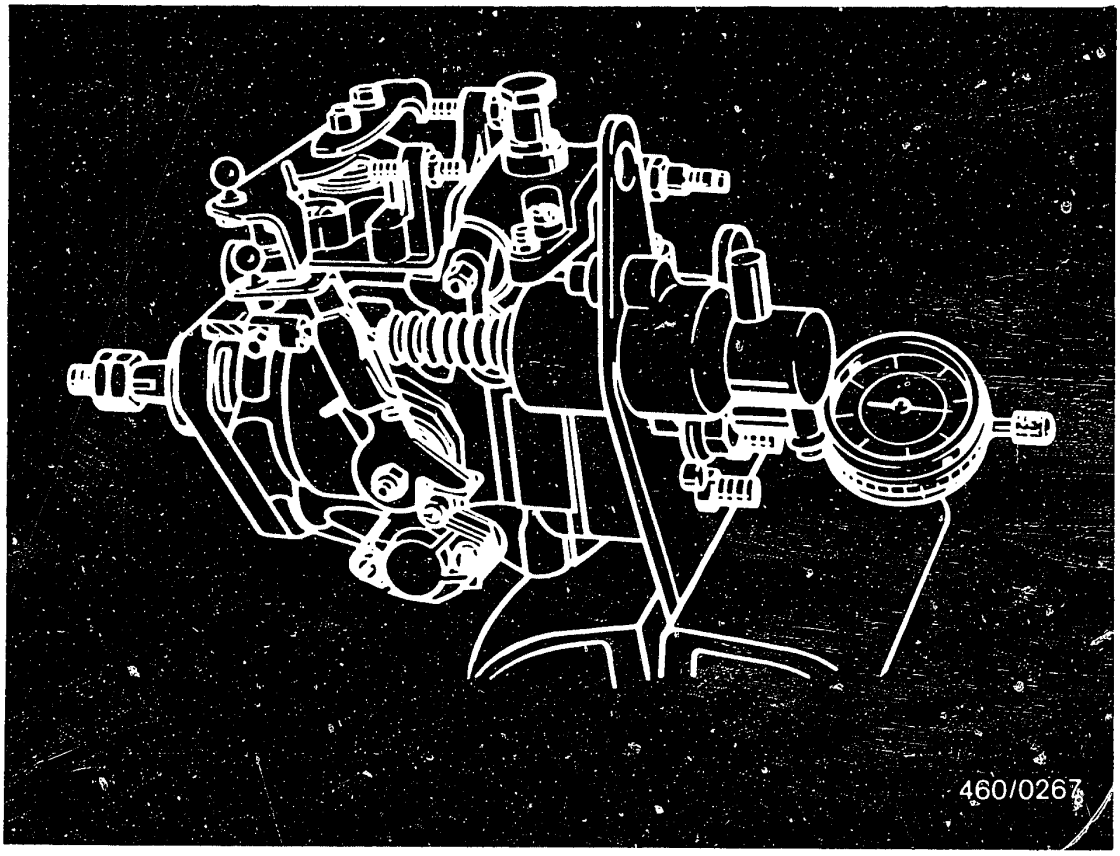
Use commercially-available clamps to clamp off the coolant hoses just behind the control device of the fuel-injection pump.

Loosen the hose clips and remove the coolant hoses.



Unscrew injection pump support bracket fastening screws on hydraulic head (arrows, Fig. a).

Remove injection-pump fastening nuts on pump flange and remove injection pump (arrow, Fig. b).



6. Putting in the fuel-injection pump

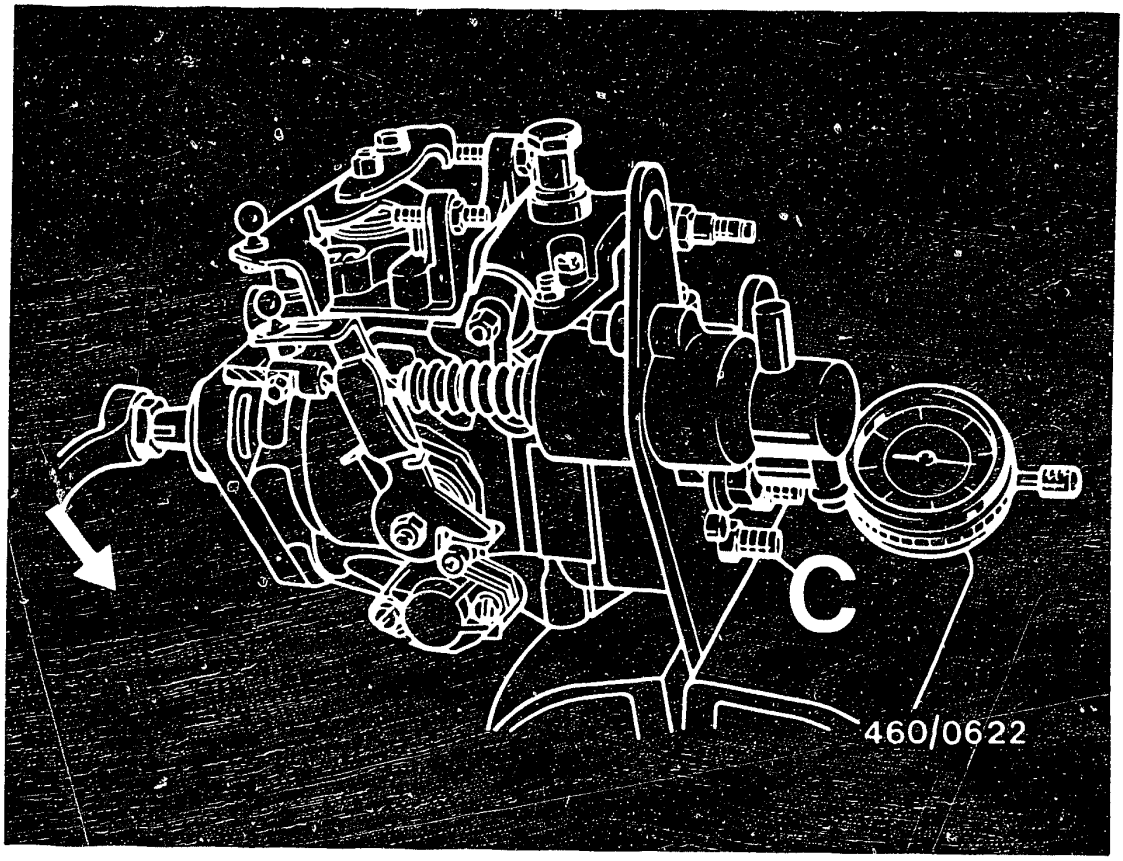
Clamp the fuel-injection pump in a vise.

Screw two hex nuts onto the drive shaft of the fuel-injection pump and lock them in place.

Remove the bleeder screw from the fuel-injection pump.

Mount measuring tool KDEP 1085 and dial indicator 1 687 233 011 in the threaded hole.

Note:
During the testing and setting of the start of delivery, the temperature-controlled cold-start accelerator must be in its rest position.

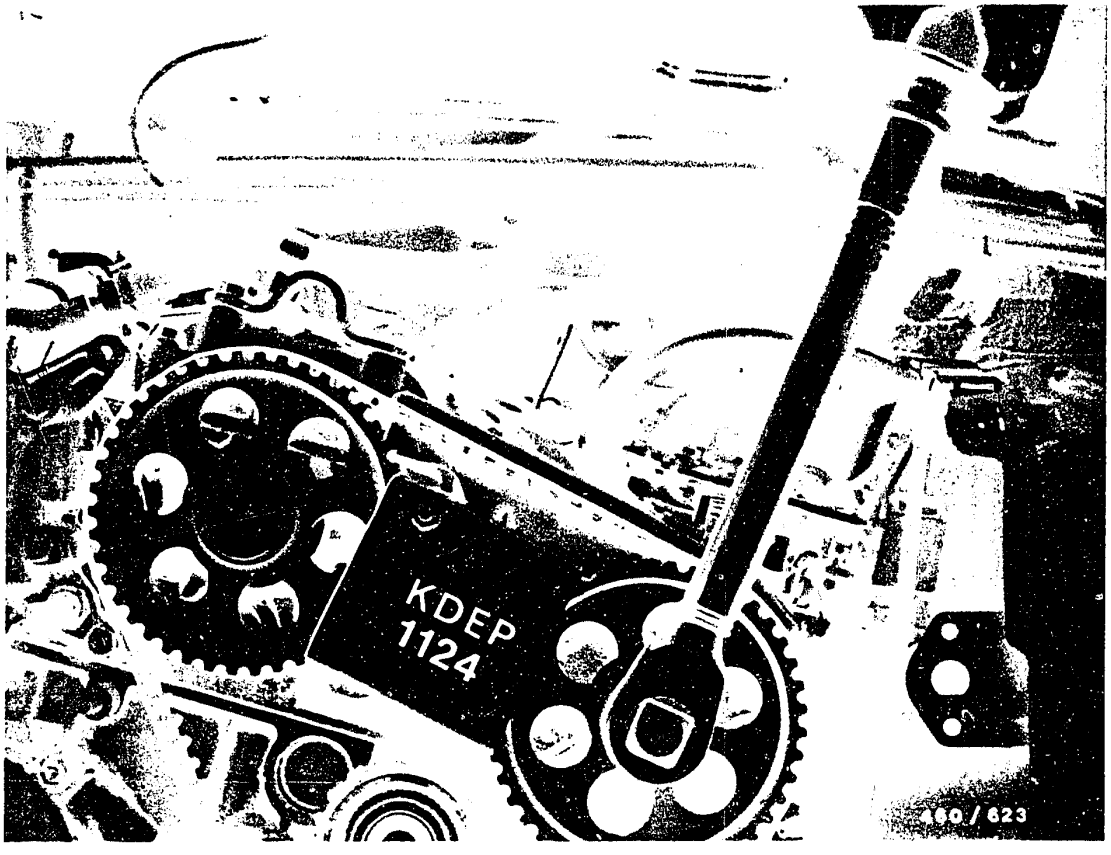


Turn pump shaft in direction of arrow until the distributor-pump plunger reaches its bottom-most position (BDC).

In this position, preload dial indicator by 3 mm and set to "0".

Continue to turn drive shaft in direction of arrow until the V-groove (once again with distributor-pump plunger in BDC position) points to outlet "C" of hydraulic head.

Unscrew hexagon nuts from drive shaft. Do not turn pump shaft any more, with result that distributor-pump plunger remains in BDC position.



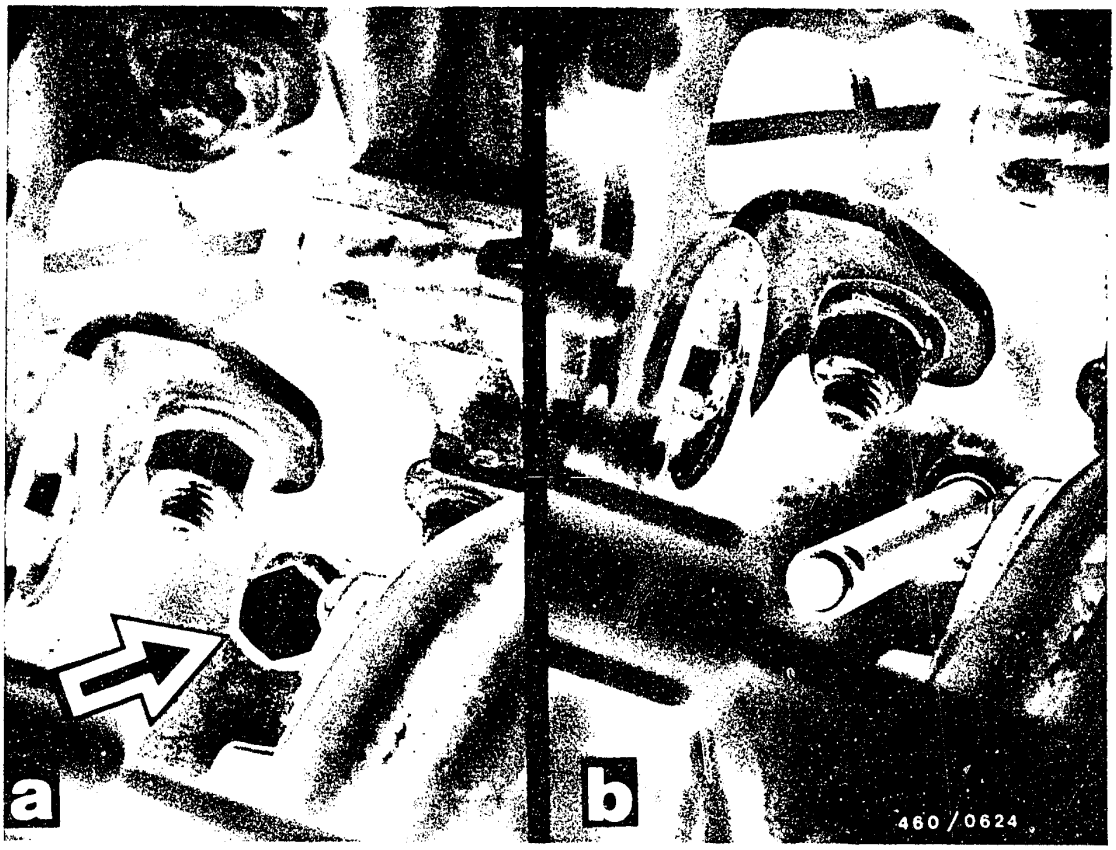
Insert Woodruff key in groove in drive shaft.

Introduce injection pump into bore in pump drive gear.

Screw on fastening nuts of injection pump by hand.

Mount plain washer and fastening nut of pump drive gear and tighten to 50 Nm

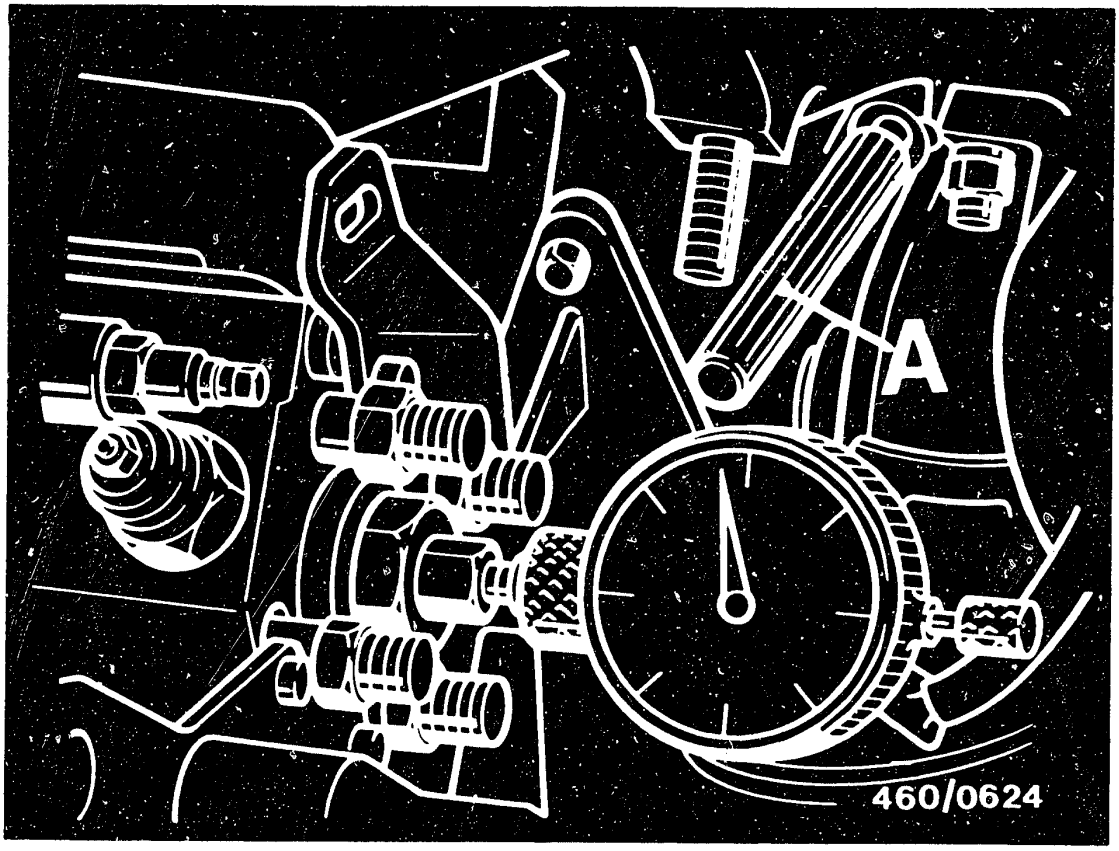
Remove holding device KDEP 1124.



Turn crankshaft over twice in engine direction of rotation and, with cylinder 1 at TDC, fix the position of the crankshaft using setting mandrel KDEP 1123.

To do this, unscrew screw plug on engine block (near injection pump) (arrow, Fig. a) and insert setting mandrel (Fig. b).

In this position, the dial indicator on the injection pump must indicate a piston stroke of 0.70 mm.
If necessary, correct by pivoting the injection pump.



A = Setting mandrel KDEP 1123

Testing the setting

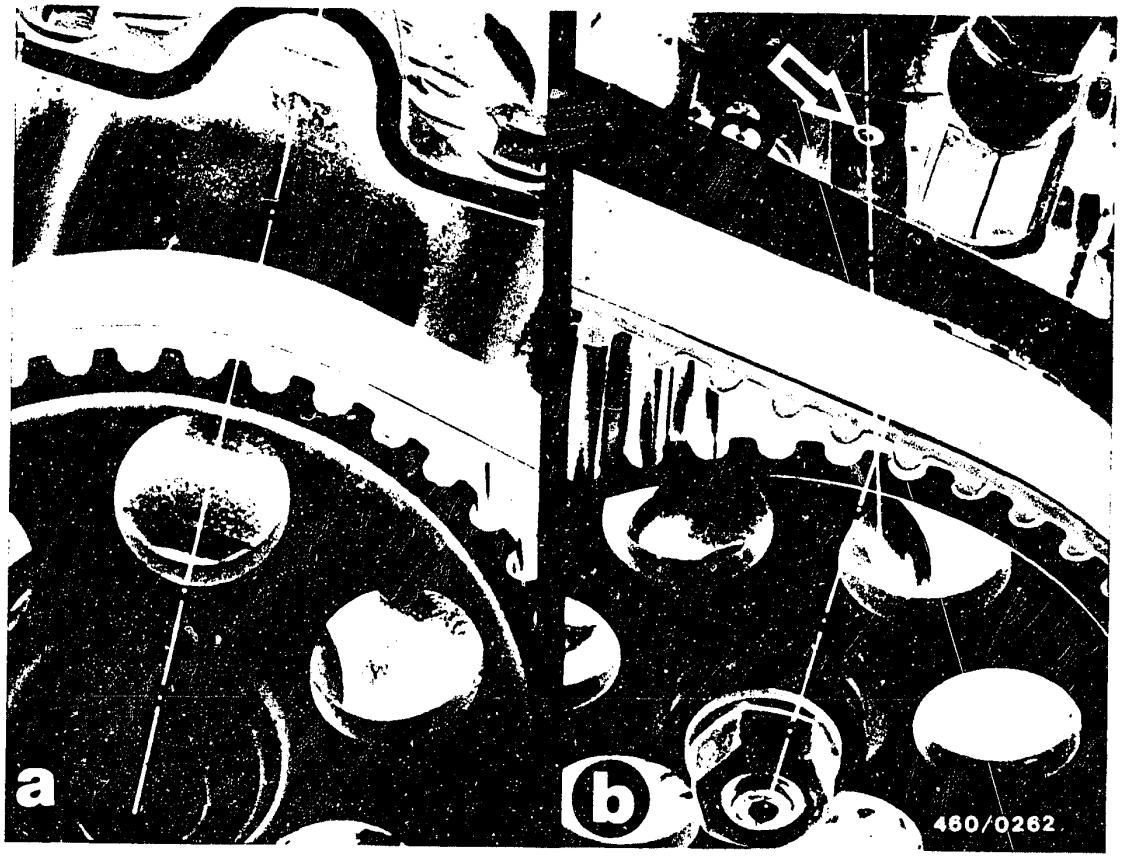
Remove setting mandrel KDEP 1123.

Turn the crankshaft 1 3/4 turns in the normal direction of rotation.

Check whether dial indicator is at "0" with distributor-pump plunger in BDC position.

Turn crankshaft further as far as TDC position (engine) and lock with setting mandrel KDEP 1123.

The dial indicator on the injection pump must indicate a piston stroke of 0,68 ... 0,72 mm.



With engine in this position, test the position of the timing gears:

Mark on camshaft gear must align with the centre line of the pipe bend on the valve cover (Fig. a).

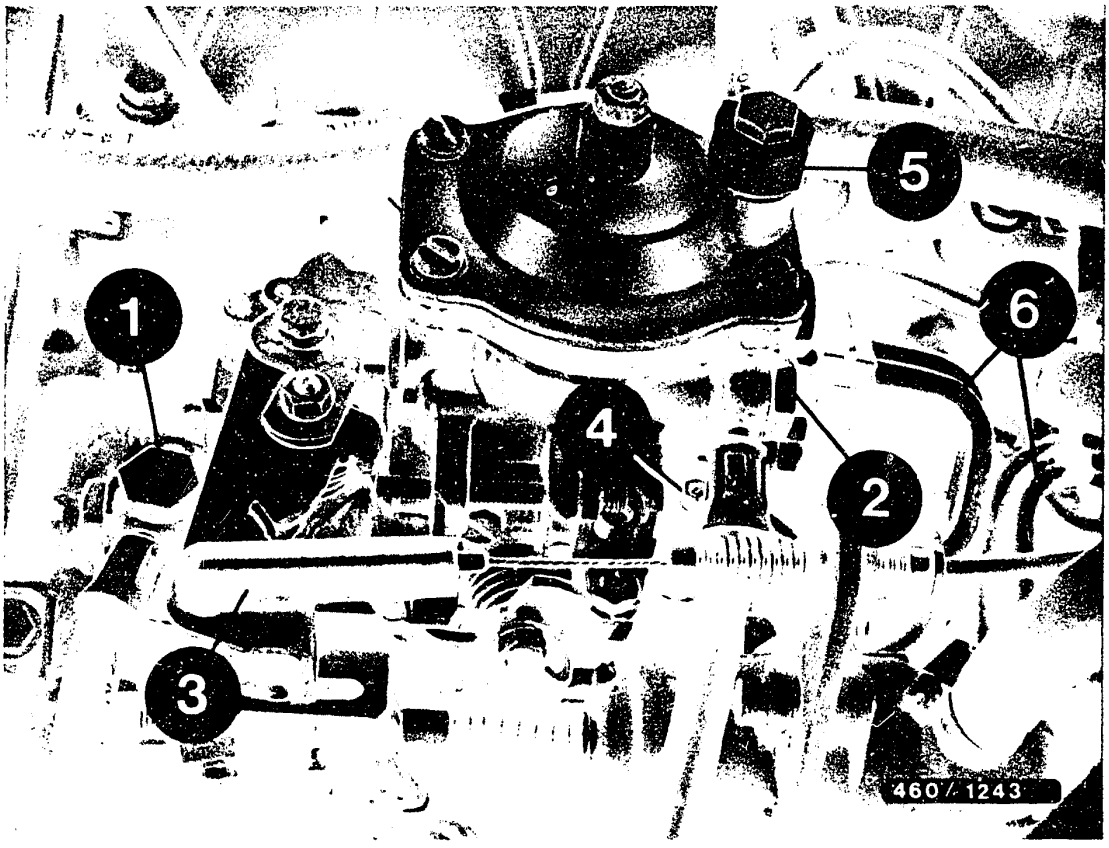
Mark on pump drive gear points to the centre line of the governor shaft bore (arrow, Fig. b).

Remove setting mandrel KDEP 1123.

Tighten injection-pump fastening nuts to 25 Nm

Remove measuring tool KDEP 1085 with dial indicator and fit bleeder screw with new copper seal ring.

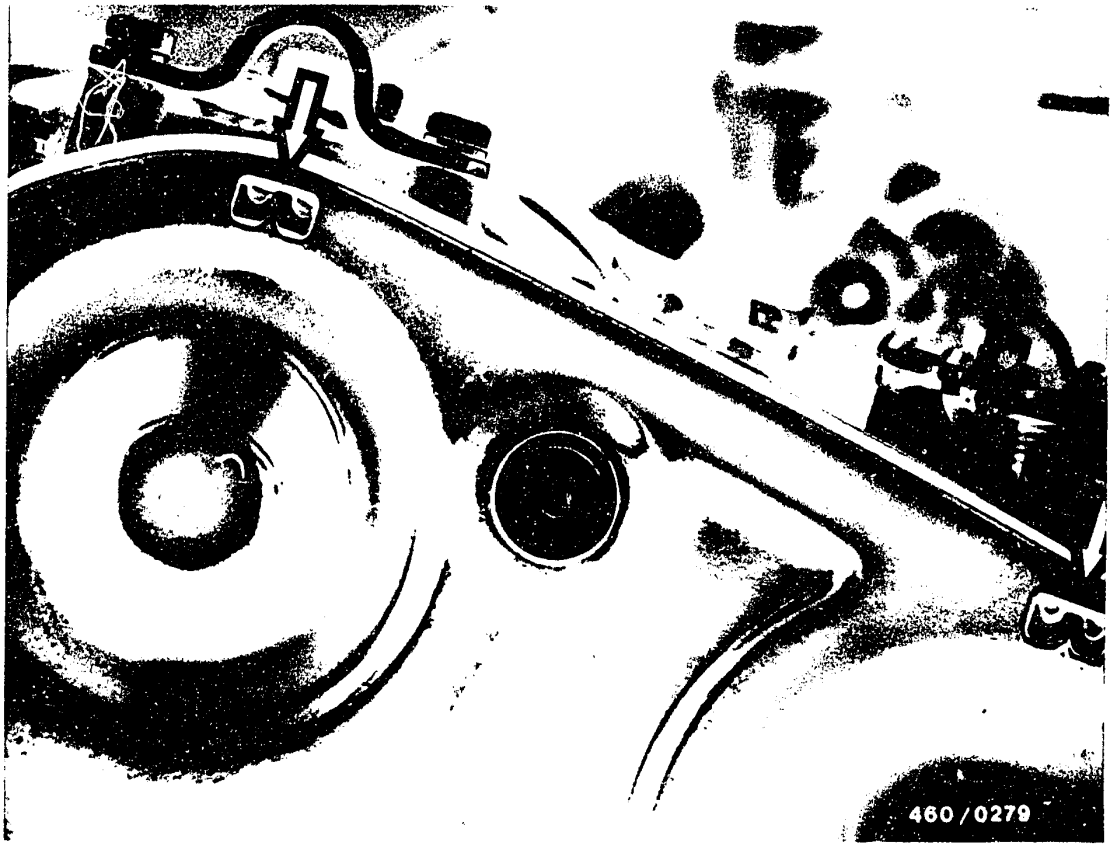
Mount support bracket on injection-pump hydraulic head and tighten fastening screws.
Put on the toothed belt cover.



Fit the fuel inlet line (1), the return line (2), the control cable for the control lever (3), the lead for the electrical shut-off device (4), the charge-air pressure connection (5) and the fuel-injection lines (6). (Steady the delivery-valve holders to prevent it from turning).

Connect the negative lead to the battery and the coolant hoses to the control device of the fuel-injection pump.

Fit the V-belts for the alternator and power-assisted steering pump, the fan wheel, the radiator, the front grille, the lock plate and the air baffle.



7. Checking and adjusting engine timing

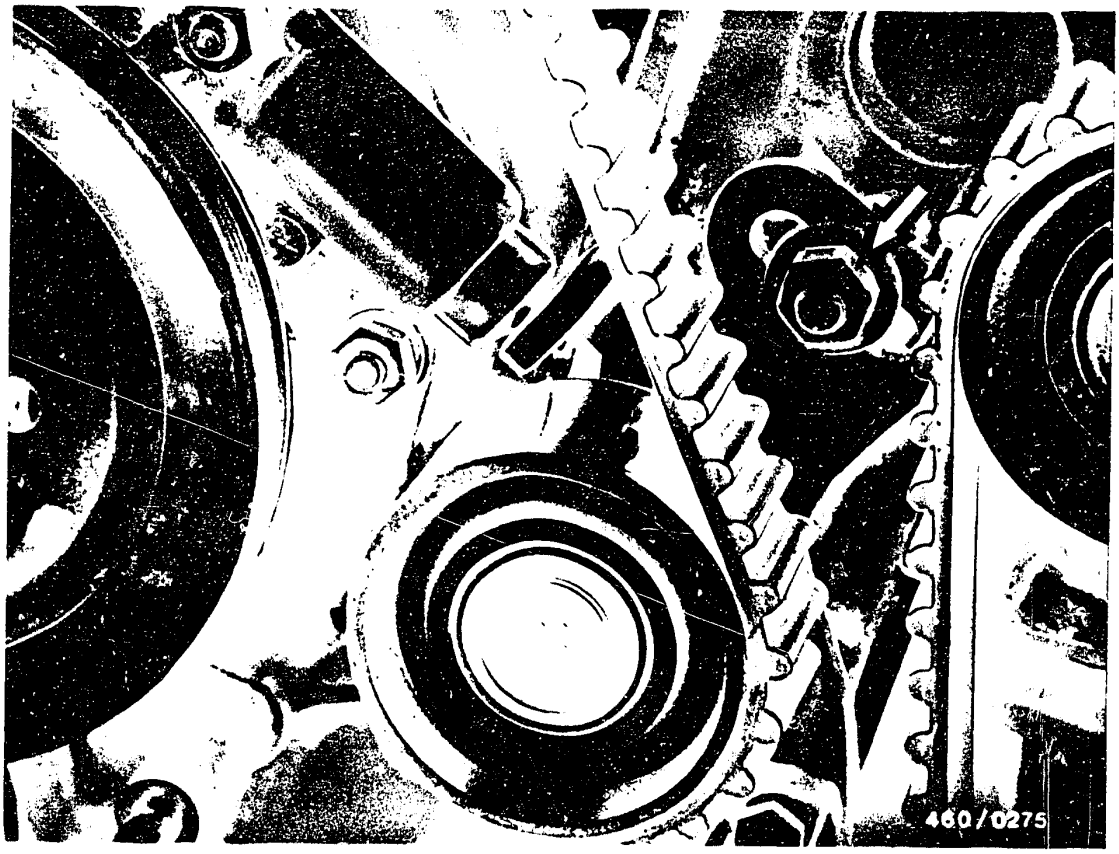
7.1 Checking engine timing

Turn the crankshaft to TDC of the first cylinder and lock it in this position using mandrel KDEP 1123.

Check that the markings on the camshaft and fuel-injection pump gears agree with the indicators on the adjustment glass (Figure).

The marking on the crankshaft gear points straight up.

If these markings do not agree with their reference markers, adjust the engine timing.



7.2 Adjusting the engine timing

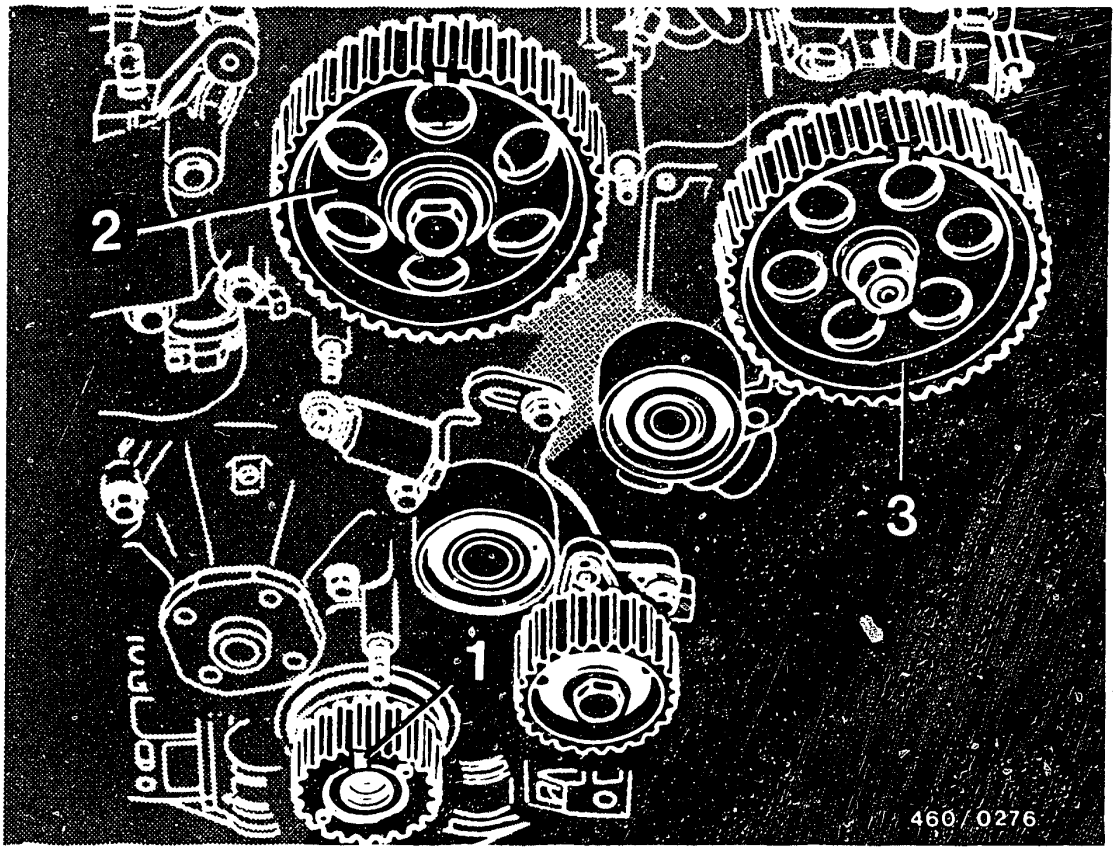
Remove the V-belts from the alternator and the power steering pump.

Take off the toothed belt cover.

Release the fastening nuts (arrow) on the tensioning wheel bracket.

Press the tensioning wheel against the spring-loaded tensioner and tighten the fastening screw for the bracket.

Take off the V-belt.

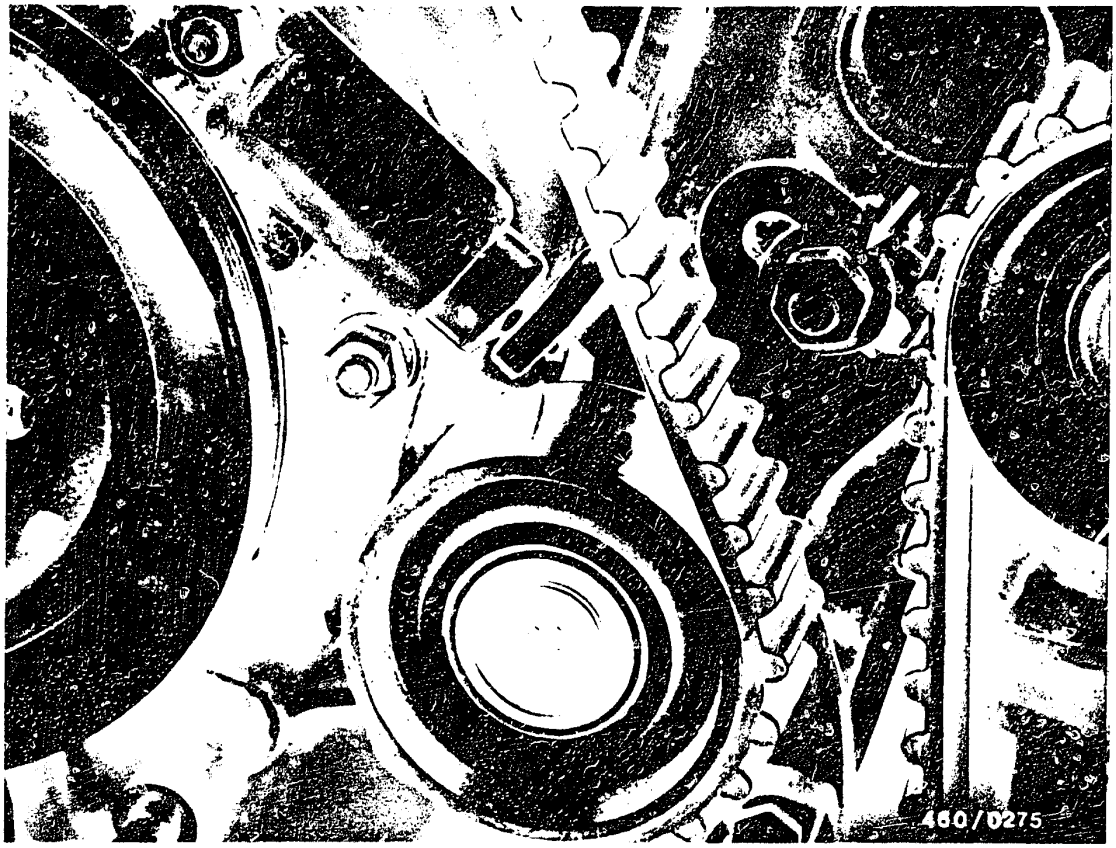


The mark on the crankshaft gear (1) must point vertically upward.

Turn camshaft gear (2) so that mark on camshaft gear aligns with centre line of valve cover.

The mark on the pump drive gear (3) points to the centre line of the governor shaft bore.

By provisionally mounting the toothed-belt cover it is possible to check the correct position of camshaft gear and injection-pump drive gear through inspection holes



Put on the toothed belt without moving the drive gears.

Loosen tensioning wheel bracket fastening screw.

Remove setting mandrel KDEP 1123.

Turn crankshaft over two full times in engine direction of rotation until marks are again in alignment.

Tighten tensioning wheel bracket fastening screw.

Test tension of toothed belt using belt tension tester KDEP 1121.

Should be: scale value 14 ... 15

Put on the toothed belt cover.
Put on and tension the V-belt for the alternator and power steering pump. Check/adjust injection timing.

8. Checking charge-air pressure

When working on the turbocharger, bear in mind that even extremely small particles of dirt can cause destruction of the charger.

Therefore, never operate the engine without an air filter.

The pressure tester KDJE-P 100, or a pressure gauge 0 ... 1.6 bar (e.g. Wika No. 4.184) can be used to check the charge-air pressure.

8.1 Measuring the charge-air pressure

The charge-air pressure is measured under full load, wherever possible on the chassis dynamometer, in fifth gear at 2500 ± 250 min^{-1} in the range from 80 ... 100 km/hr.

Read the charge-air pressure from the pressure gauge.

Specified value: 0.6 bar ± 0.025

Notes:

Prerequisites for evaluation of the exhaust gas turbocharger are that the start of fuel delivery and nozzle opening pressure have been correctly adjusted, there are no leaks in the intake or exhaust systems, and the mechanical condition of the engine (valve clearance, compression pressure) is OK.

If the wastegate is defective, take out and replace the exhaust gas turbocharger.

After putting in a new exhaust gas turbocharger, fill the charger with oil and run the engine for approx. 1 minute at idle so that the oil supply to the charger is assured.

TABLE OF CONTENTS

SPECIAL FEATURES

This microcard contains the trouble-shooting instructions for the diesel fuel-injection system on the following vehicles current at the time of writing:

Renault R 25 D, R 25 D-Turbo (1.84->)

1. Test specifications

1.1	Idle speed:	
	R 25 D	700 ... 800 min^{-1}
	R 25 D-Turbo	700 ... 750 min^{-1}
1.2	Nozzle-opening pressure:	130 + 8 bar
1.3	Pump - engine coordination	
	Engine position:	1rst cylinder at TDC
	Inspection value:	
	Pump position:	0.68...0.72 mm after BDC
	Setting value:	
	Pump position:	0.70 mm after BDC
1.4	Compression:	20 ... 30 bar
1.5	Charge-air pressure:	0.6 bar $\pm$ 0.025

1.6 Toothed-belt tension

Scalar value	14 ... 15

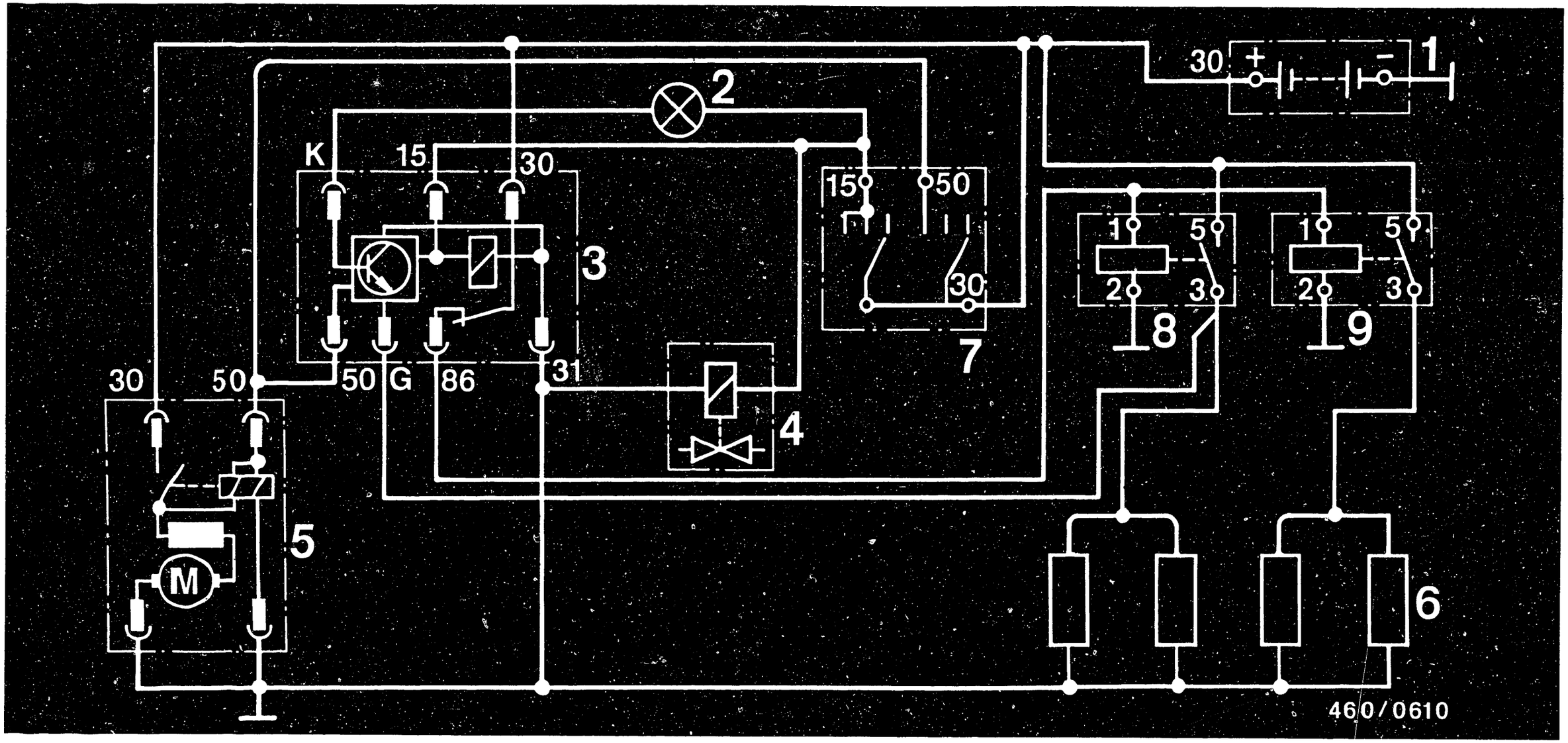
1.7 Tightening torques

Fuel-injection pump fastening screws	25 Nm
Injection-pump gear (hexagon nut)	50 Nm
Nozzle-holder assembly	17 Nm
Fuel lines	25 Nm
Screw plug	10 Nm
Injection-pump support bracket (fastening screws)	25 Nm
Sheathed-element glow plugs	40 Nm

● Note:
The engine in the Renault R 25 D, R 25 D-Turbo essentially corresponds to that of the Renault R 20 D, R 20 D-Turbo. Similar SIS repair instructions: REN-500 microcard.

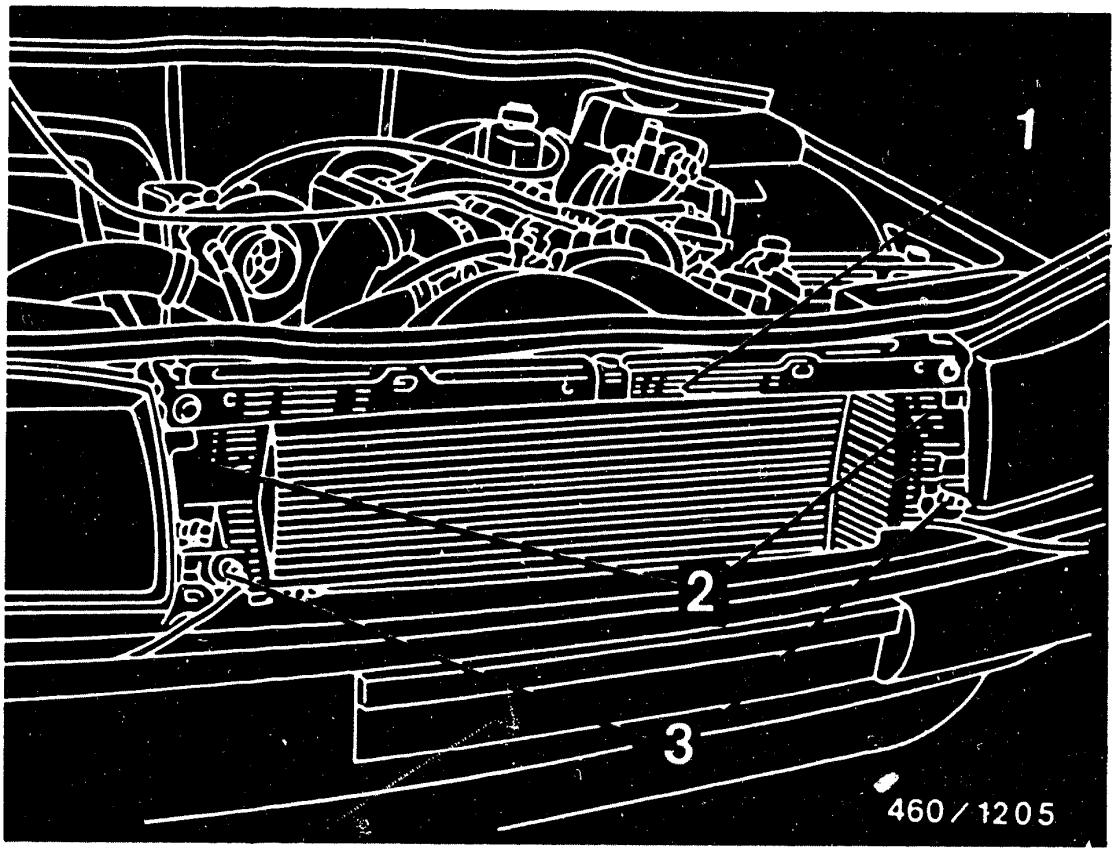
2. Test equipment and tools

Description	Part Number	Use
Puller	KDEP 1118	Removing injection-pump gear
Setting mandrel	KDEP 1123	Locking crankshaft
Holding device	KDEP 1124	For locking the pump drive gear
Toothed-belt tester	KDEP 1121	Testing tension of toothed belt
Box wrench	KDEP 1115	Loosening/tightening injection lines
Pressure tester or pressure gauge 0 ... 1.6 bar	KDJE-P 100 e.g. Wika No. 4184	Testing charge-air pressure
Measuring tool	KDEP 1085	Injection timing
Mini dial indicator 1 / 100 mm divisions	Commercially available e.g. Hahn & Kolb 7000 Stuttgart Part No. 33 003 with adapter KDEP 1127	Injection timing



1 = Battery
2 = Glow-plug indicator lamp (12 V 2 W)
3 = Glow-duration unit
4 = Solenoid-operated valve
5 = Starting motor
6 = Sheathed-element glow plugs
7 = Glow-plug and starter switch
8 = Power relay
9 = Power relay

3. Terminal diagram of pre-heating system in Renault 25 D, 25 D-Turbo



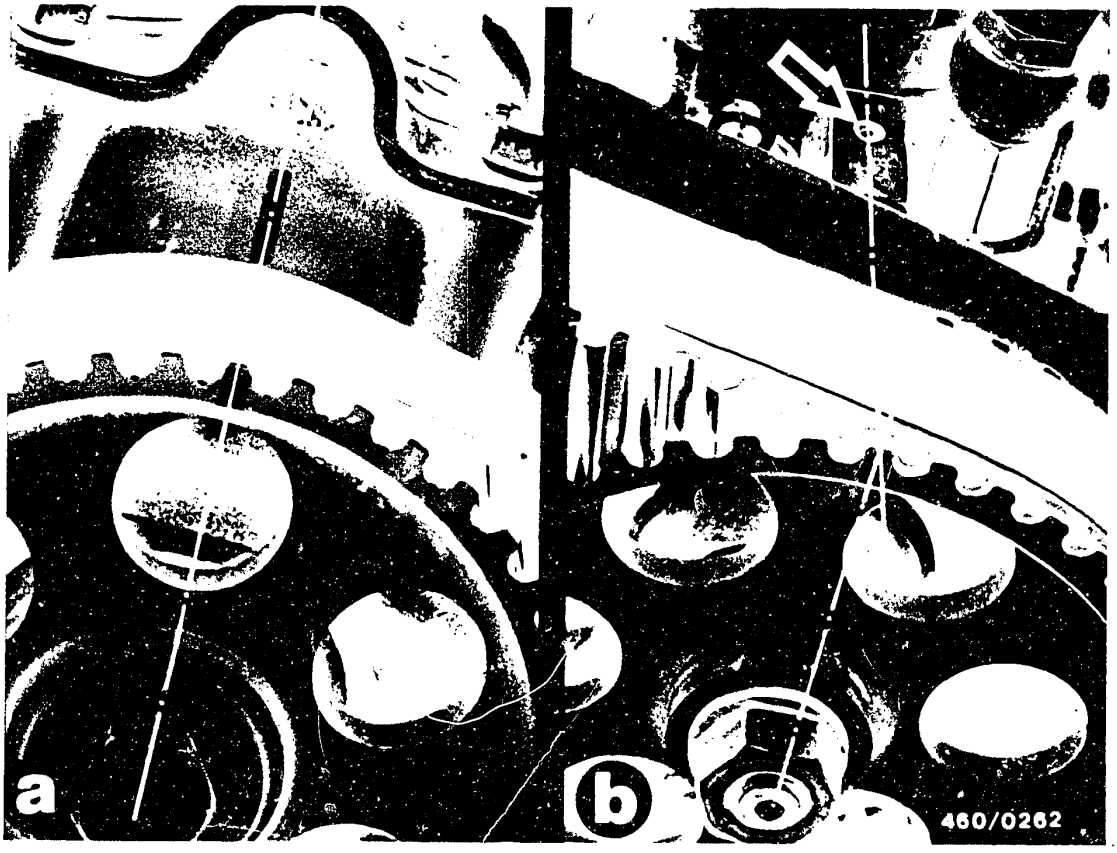
4. Removing the fuel-injection pump

Disconnect the negative lead from the battery.
Remove the headlamp wiper arms.

Remove the fastening screws (Torx screws) from the front panel.
Tilt the front panel slightly forward and remove from the bottom pins.

Remove the cross member (1), side panels (2), and headlamp wiper motors (3).

Pull the radiator up and forwards out of the engine compartment.
Support the radiator from the bottom.

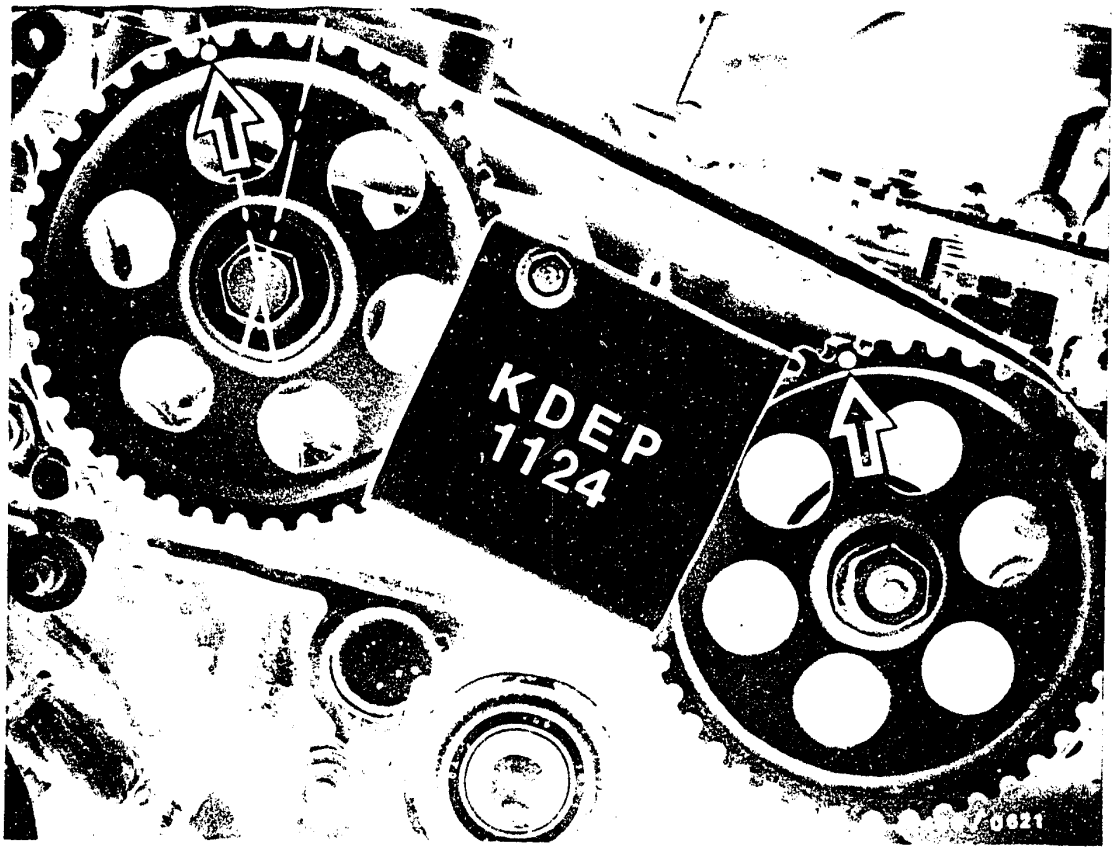


Remove the fan wheel.
Remove the V-belts from the alternator and power steering pump. Take off the toothed-belt cover.

Turn the crankshaft to TDC of cylinder 1.

In this position, the marking on the camshaft gear is aligned with the center axis of the valve cover (Figure a).

The marking on the pump drive gear will then point to the center axis of the governor shaft hole (Figure b).



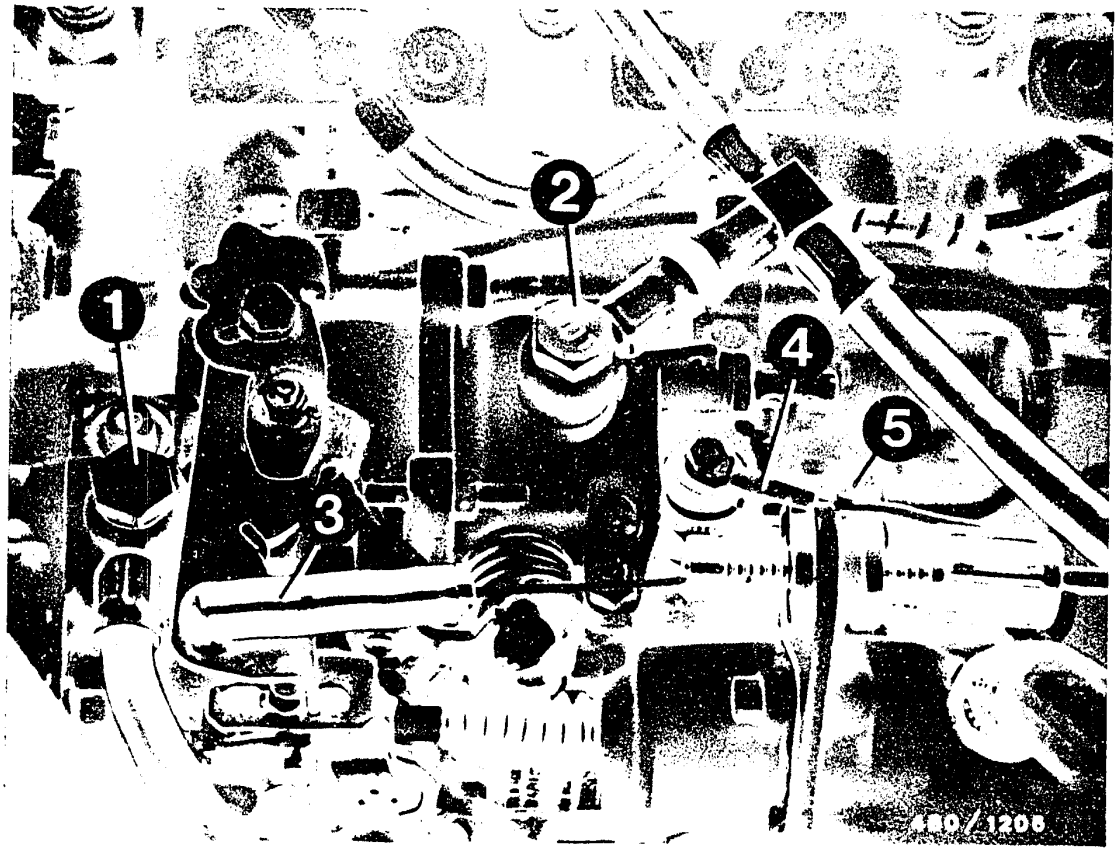
Turn back crankshaft until the mark on the camshaft gear is three teeth before TDC mark on valve cover.

Insert holding device KDEP 1124 between camshaft gear and pump drive gear and secure.

Loosen the fastening nut of the fuel-injection pump gear and unscrew about 2 turns.

Pull off the gear with puller KDEP 1118.

Remove the fastening screw and washer from the fuel-injection pump drive shaft.

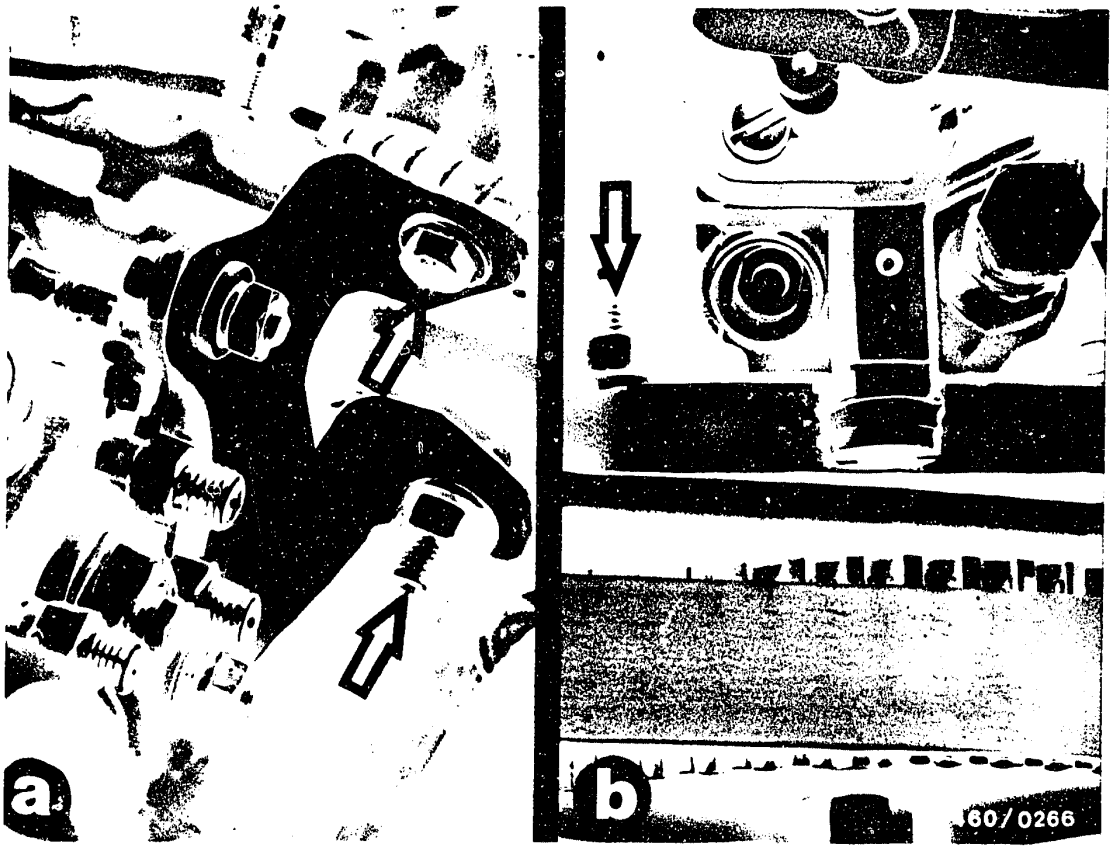


Remove the fuel supply line(1), return line (2), bowden cable at control lever (3), lead for electrical shutoff device (4), and fuel-injection tubing (5). (Counterhold to prevent loosening of the delivery-valve holders).

On the R 25 D-Turbo, remove the charge-air pressure connection (not visible in illustration).

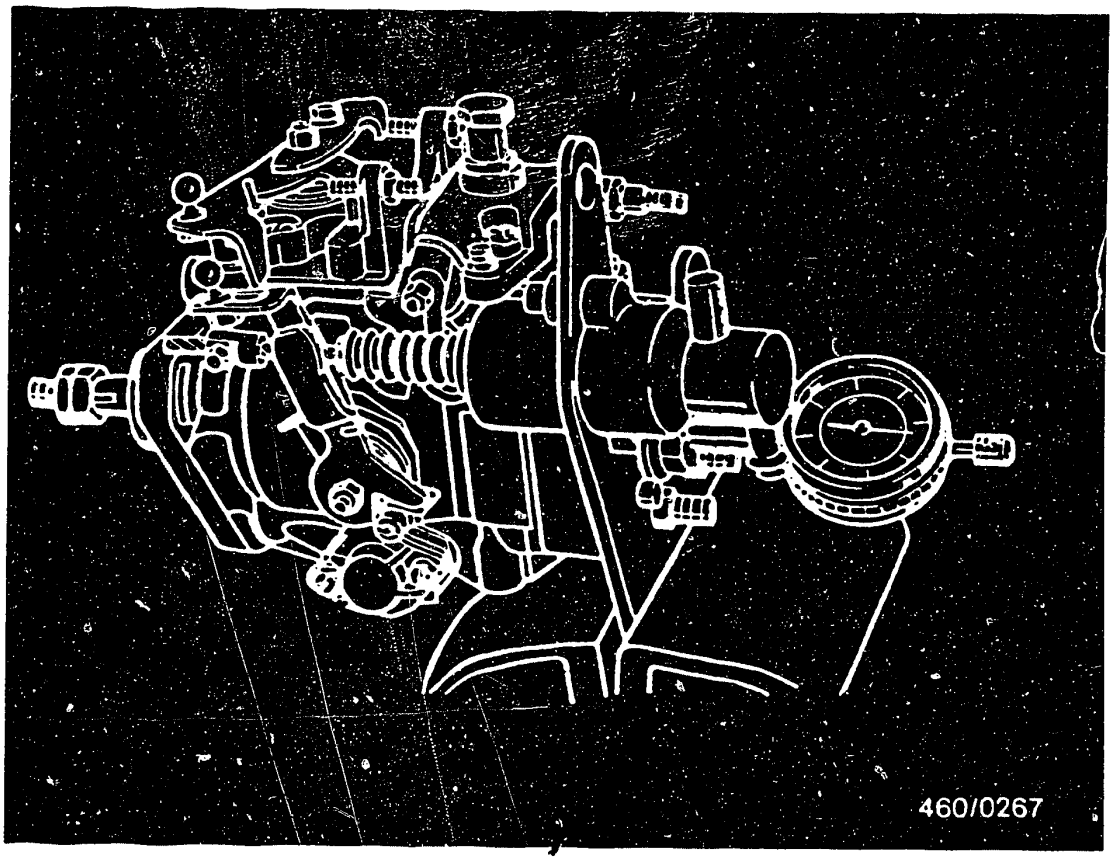
Pinch off the coolant hoses a short distance behind the fuel-injection pump control device using commercially-available spring clips.

Loosen the hose clamps and pull off the coolant hoses.



Unscrew injection pump support bracket fastening screws (arrows, Fig. a).

Remove injection-pump fastening nuts on pump flange and remove injection pump (arrow, Fig. b).



5. Install fuel-injection pump

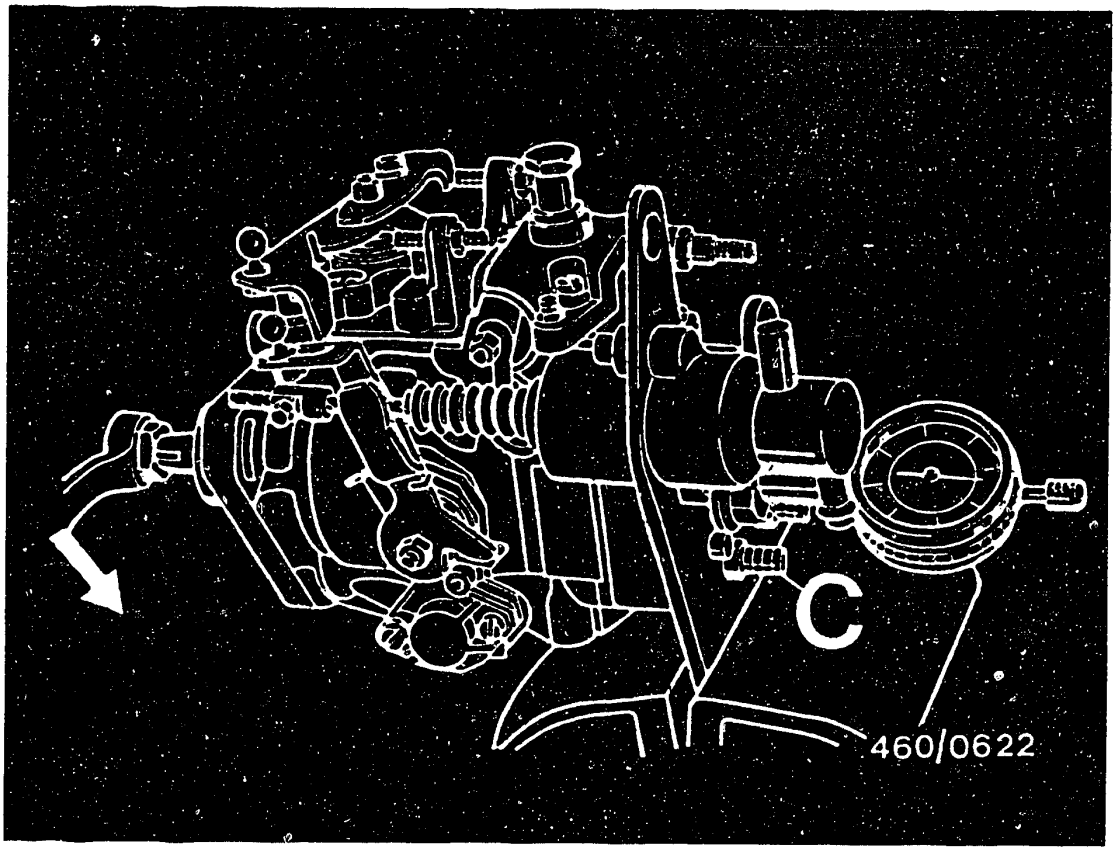
Clamp fuel-injection pump in a vice.

Screw two hexagon nuts onto the injection-pump drive shaft and lock.

Remove injection-pump bleeder screw.

Install measuring device KDEP 1085 with dial indicator 1 687 233 011 in the tapped hole.

Note:
When testing and adjusting start of delivery, the cold-start injection advance (KSB) must be at zero position.

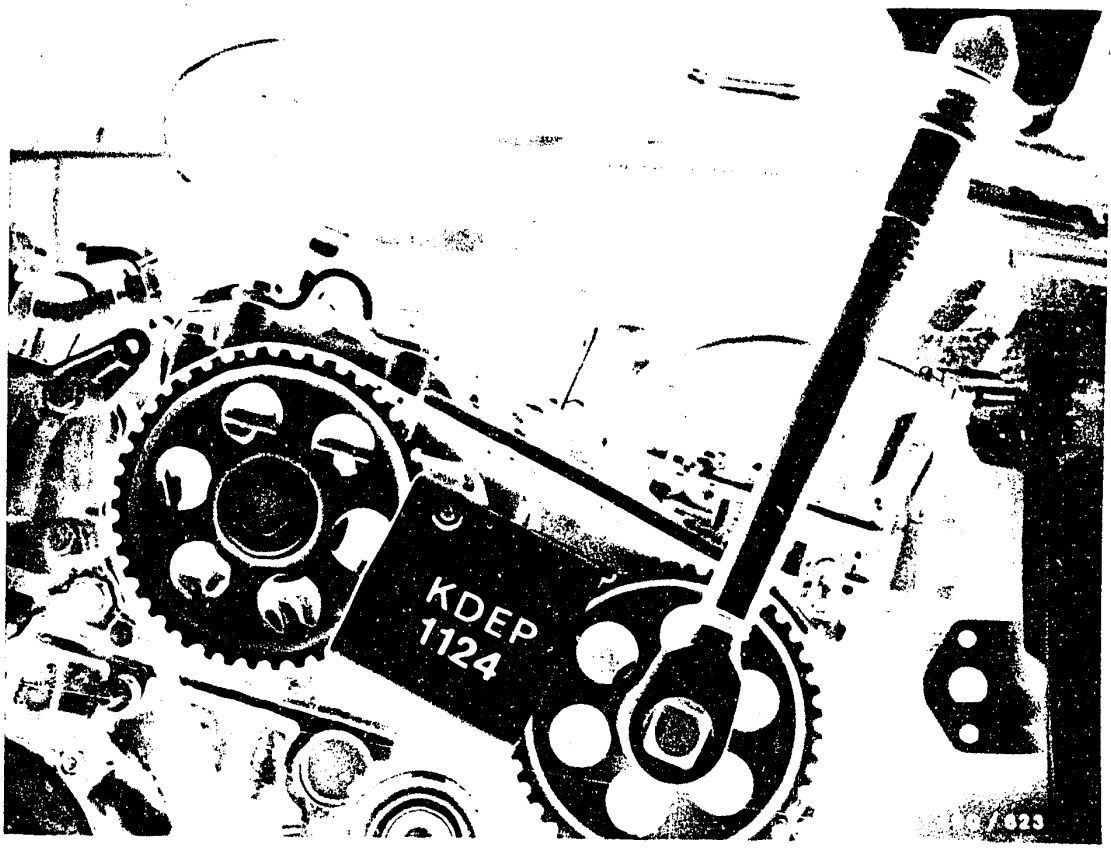


Turn pump shaft in direction of arrow until the distributor-pump plunger reaches its bottom-most position (BDC).

In this position, preload dial indicator by 3 mm and set to "0".

Continue to turn drive shaft in direction of arrow until the V-groove (once again with distributor-pump plunger in BDC position) points to outlet "C" of hydraulic head.

Unscrew hexagon nuts from drive shaft. Do not turn pump shaft any more, with result that distributor-pump plunger remains in BDC position.



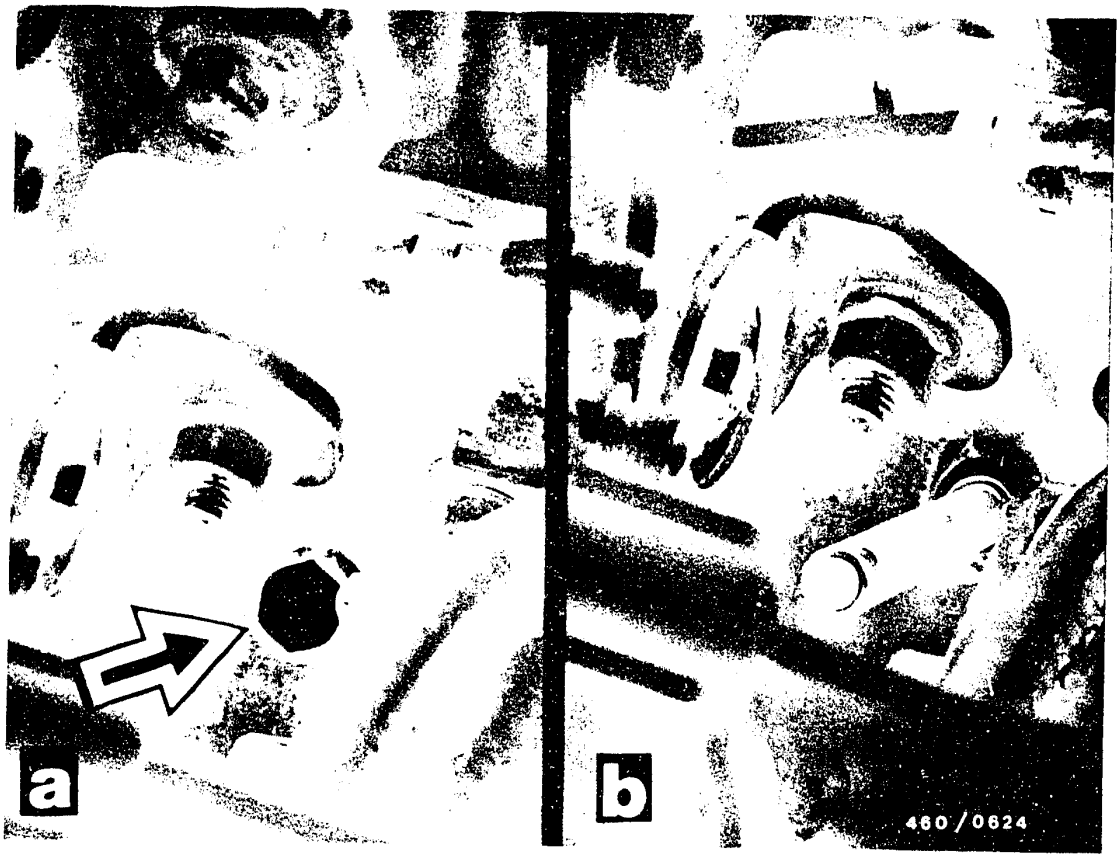
Insert Woodruff key in groove in drive shaft.

Introduce injection pump into bore in pump drive gear.

Screw on fastening nuts of injection pump by hand.

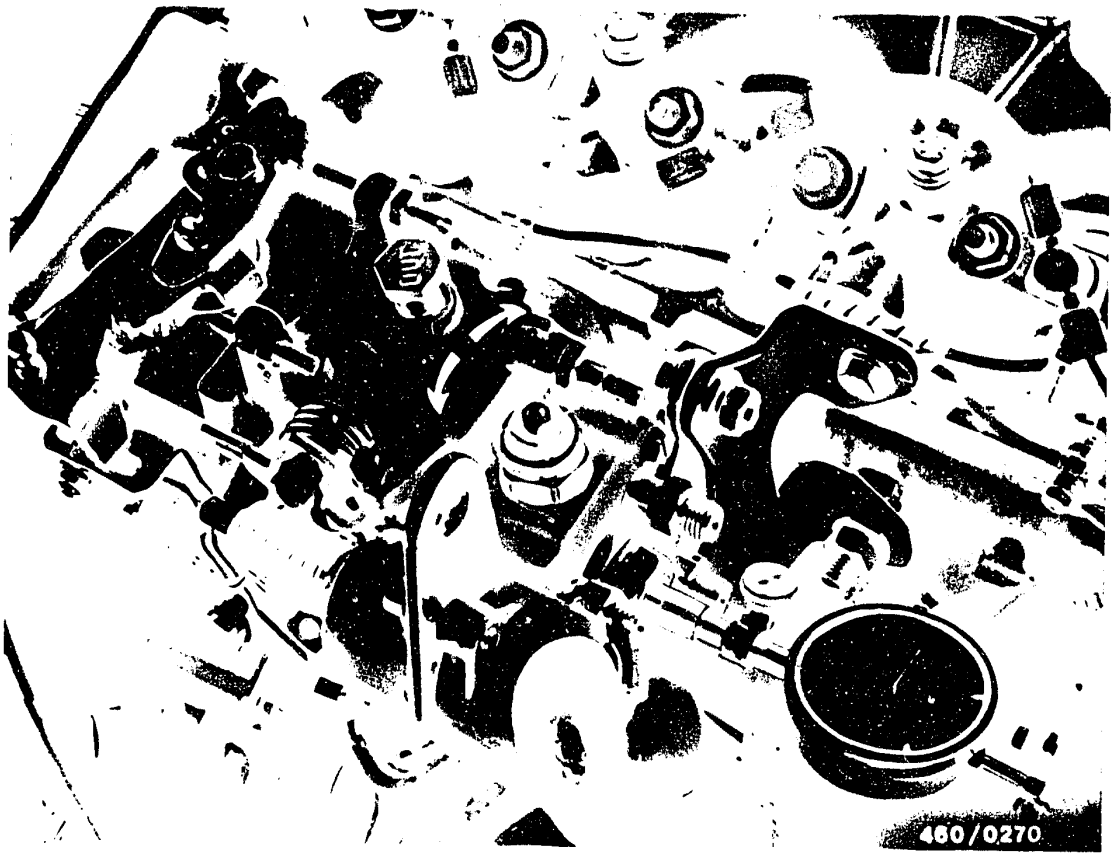
Mount plain washer and fastening nut of pump drive gear and tighten to 50 Nm.

Remove holding device KDEP 1124.



Turn crankshaft over twice in engine direction of rotation and, with cylinder 1 at TDC, fix the position of the crankshaft using setting mandrel KDEP 1123.

To do this, unscrew screw plug on engine block (near injection pump) (arrow, Fig. a) and insert setting mandrel (Fig. b).



In this position, the dial indicator on the injection pump must indicate a piston stroke of 0.70 mm.
If necessary, correct by pivoting the injection pump.

Testing the setting

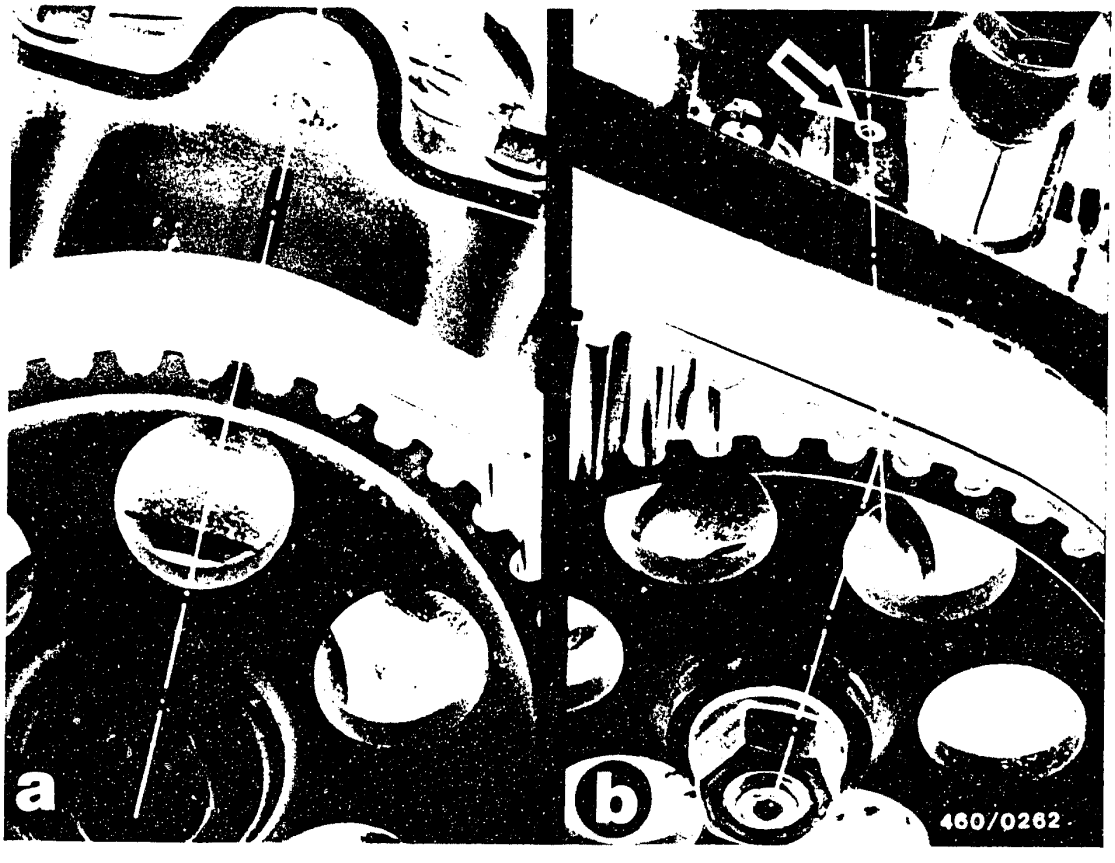
Remove setting mandrel KDEP 1123.

Turn crankshaft 1 3/4 turns in direction of rotation.

Check whether dial indicator is at "0" with distributor-pump plunger in BDC position.

Turn crankshaft further as far as TDC position (engine) and lock with setting mandrel KDEP 1123.

The dial indicator on the injection pump must indicate a piston stroke of 0.68 ... 0.72 mm.



With engine in this position, test the position of the timing gears:

Mark on camshaft gear must align with the centre line of the pipe bend on the valve cover (Fig. a).

Mark on pump drive gear points to the centre line of the governor shaft bore (arrow, Fig. b).

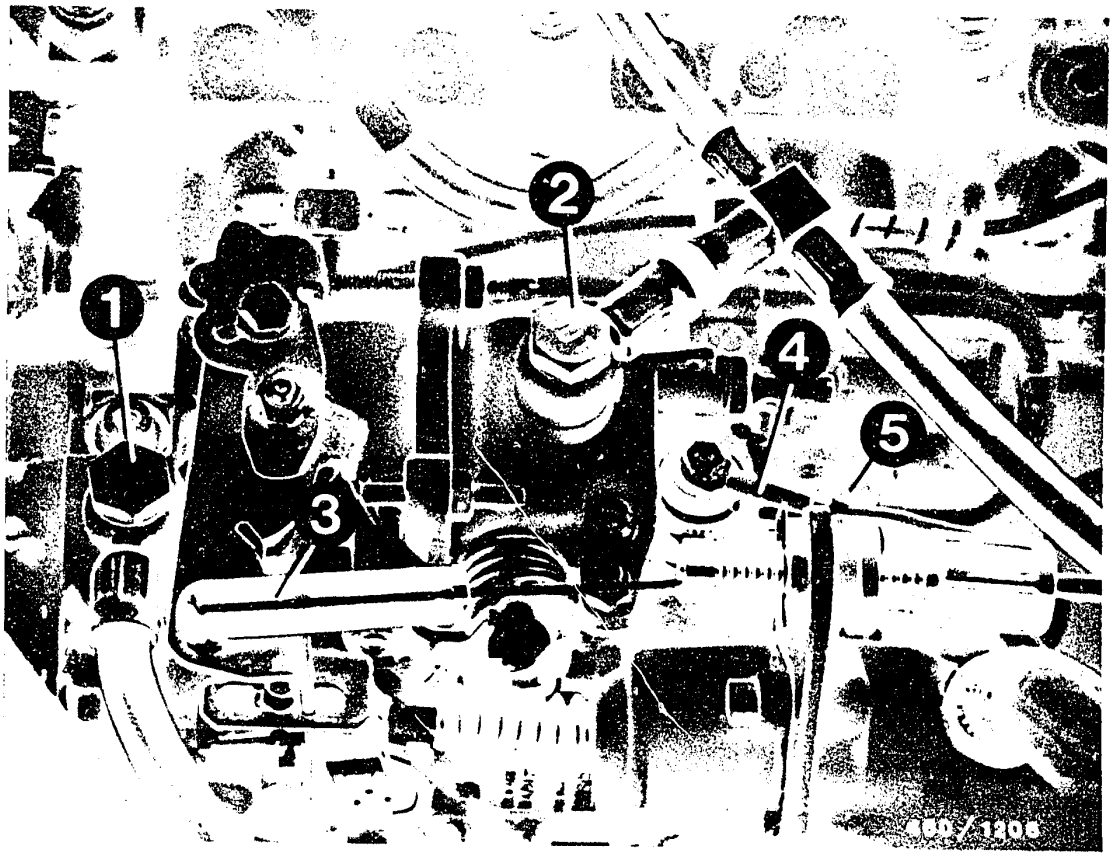
Remove setting mandrel KDEP 1123.

Tighten injection-pump fastening nuts to 25 Nm.

Remove measuring tool KDEP 1085 with dial indicator and fit bleeder screw with new copper seal ring.

Mount support bracket on injection-pump hydraulic head and tighten fastening screws.

Install the toothed-belt cover.

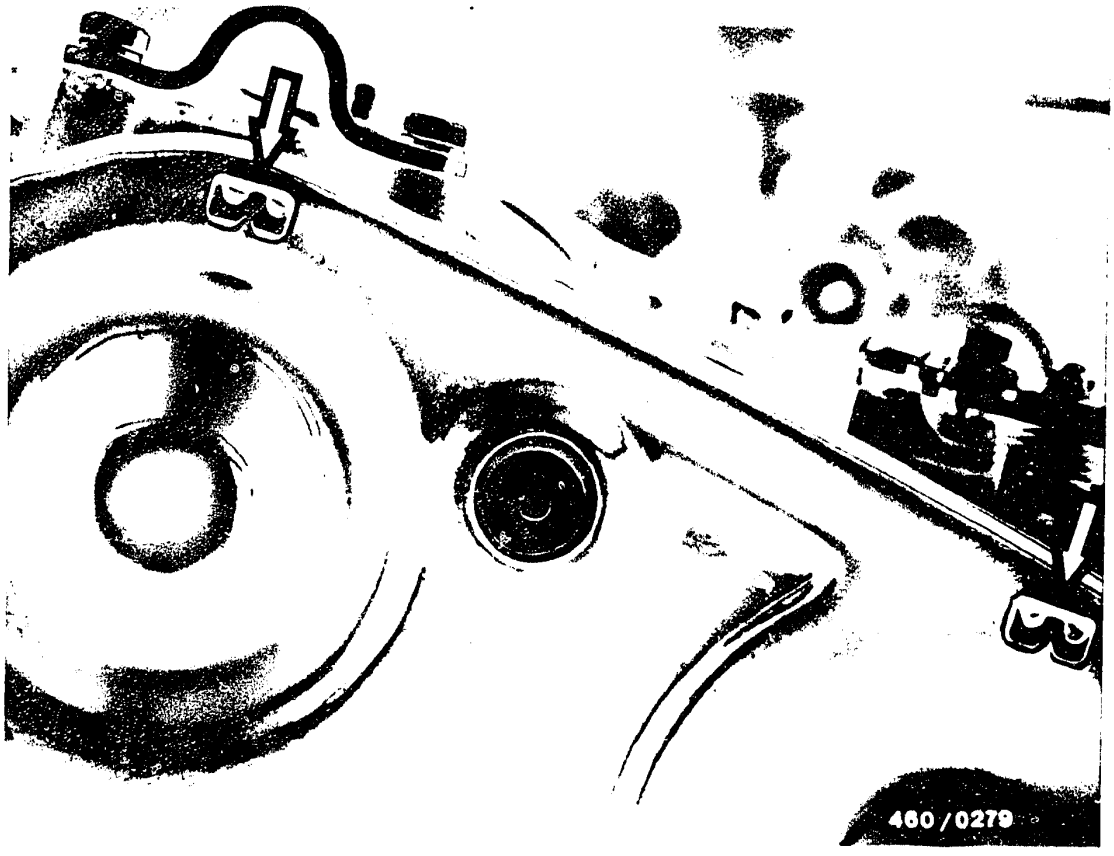


Install the fuel supply line (1), return line (2), bowden cable at the control lever (3), lead for electrical shutoff device (4), and fuel-injection tubing (5). (Counterhold to prevent turning of the delivery-valve holders).

On the R 25 D-Turbo, install the charge-air pressure connection.

Connect the negative lead to the battery and the coolant hoses to the control device of the fuel-injection pump.

Mount the V-belts for the alternator and power steering pump, the fan wheel, radiator, cross member, side panels, headlamp wiper motors, and front panel.



6. Testing and adjusting engine timing

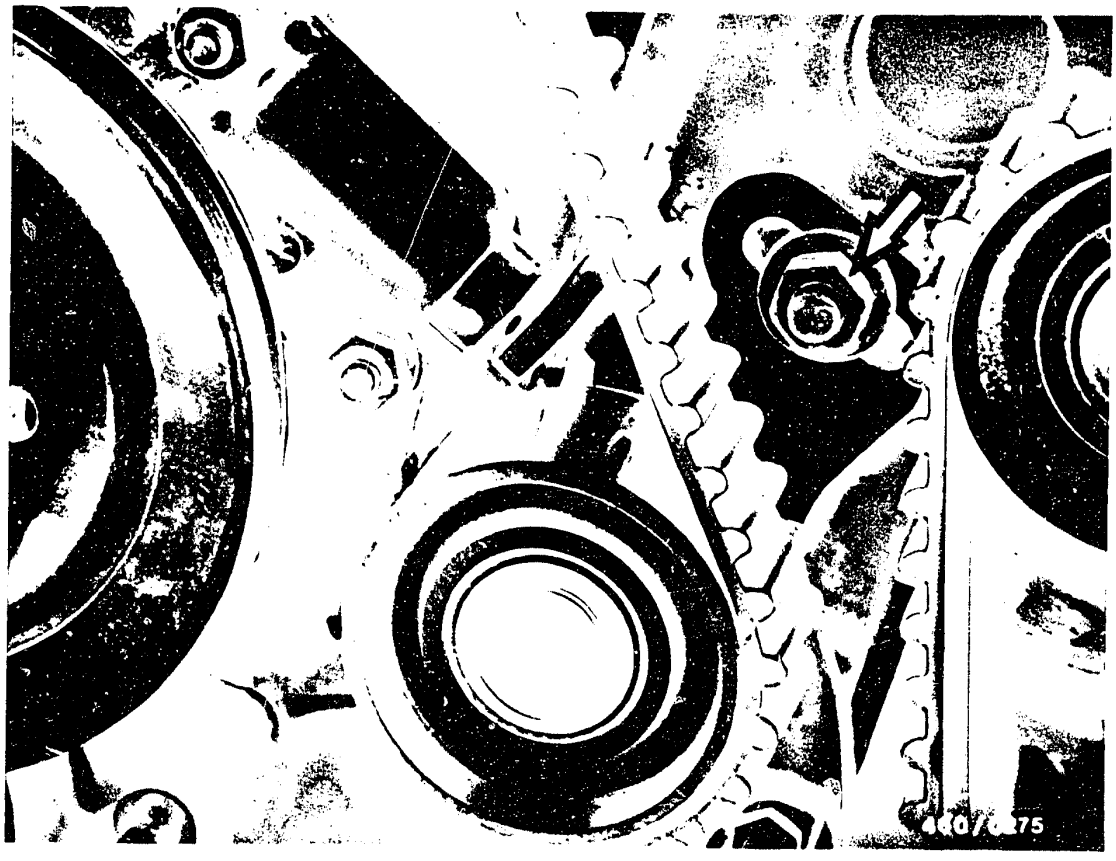
6.1 Testing engine timing

Turn the crankshaft to TDC of cylinder 1, and hold in this position with setting mandrel KDEP 1123.

Check whether the markings on the camshaft and fuel-injection pump gears are aligned with the pointers of the adjustment windows (illustration).

The marking on the crankshaft gear points vertically upwards.

If these markings do not align with their reference marks, adjust the engine timing.



6.2 Adjusting engine timing

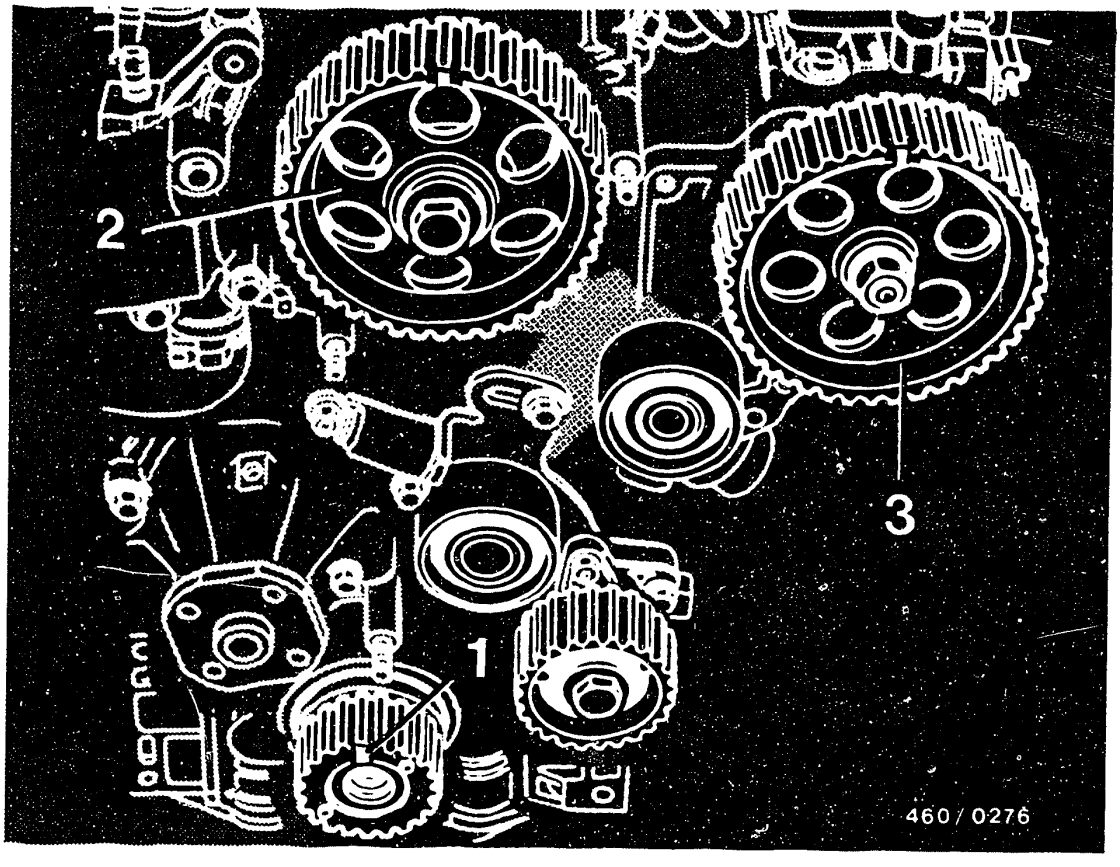
Remove the V-belts from the alternator and power steering pump.

Take off the V-belt cover.

Loosen the fastening nuts (arrow) of the tensioning-wheel bracket.

Press the tensioning wheel against the spring tensioner and tighten the fastening screw of the bracket.

Remove V-belts.

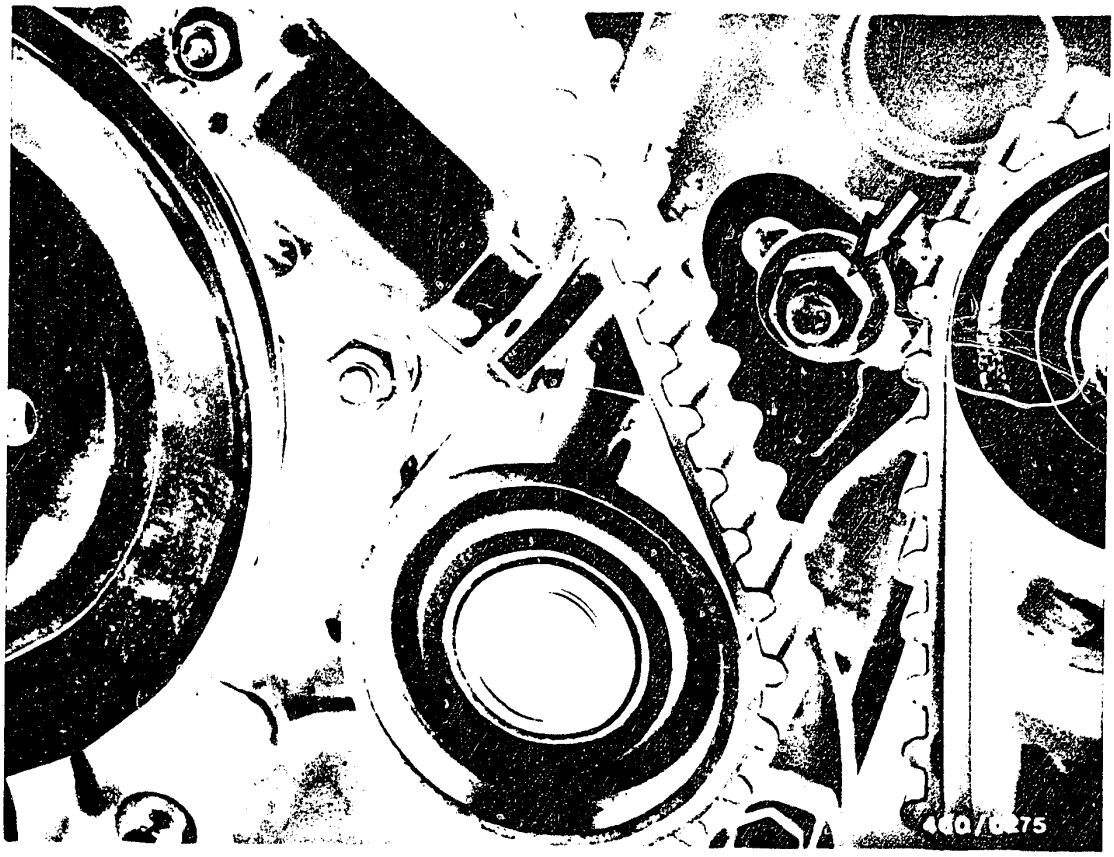


The mark on the crankshaft gear (1) must point vertically upward.

Turn camshaft gear (2) so that mark on camshaft gear aligns with centre line of valve cover.

The mark on the pump drive gear (3) points to the centre line of the governor shaft bore.

By provisionally mounting the toothed-belt cover it is possible to check the correct position of camshaft gear and injection-pump drive gear through inspection holes.



Put on the toothed belt without moving the drive gears.

Loosen tensioning wheel bracket fastening screw.

Remove setting mandrel KDEP 1123.

Turn crankshaft over two full times in engine direction of rotation until marks are again in alignment.

Tighten tensioning wheel bracket fastening screw.

Check toothed-belt tension using belt-tension testing tool KDEP 1121.

Setting value: Scalar value 14 ... 15

Mount V-belt cover.
Position and tension V-belts for the alternator and power steering pump. Test and if necessary adjust the coordination of the fuel-injection pump and the engine.

7. Test charge-air pressure

When working on the turbocharger, it should be noted that even the smallest particles of dirt can lead to the destruction of the turbocharger.
Therefore, never operate the engine without air filter.

To test the charge-air pressure, it is possible to use the pressure tester KDJE-P 100 or a pressure gauge 0...1,6 bar (e. g. Wika No. 4184).

7.1 Measuring the charge-air pressure

The charge-air pressure is measured at full load, if possible on chassis dynamometer, at 2250 ± 250 min^{-1} in the range from 80 ... 100 km/h in 5th gear.

Read off charge-air pressure on pressure gauge.

Set value: 0.6 bar ± 0.025

Note:

To assess the exhaust-gas turbocharger, it is essential that the start of delivery and nozzle-opening pressure be correctly set, that the air-intake and exhaust systems do not have any leaks, and that the engine (valve clearance, compression pressure) is in good mechanical condition.

If the charge-air-pressure control valve is defective, replace the exhaust turbo-supercharger.

After installing a new exhaust turbo-supercharger, fill the supercharger with oil and let the engine run for approx. 1 minute in idle in order to assure oil supply to the supercharger.

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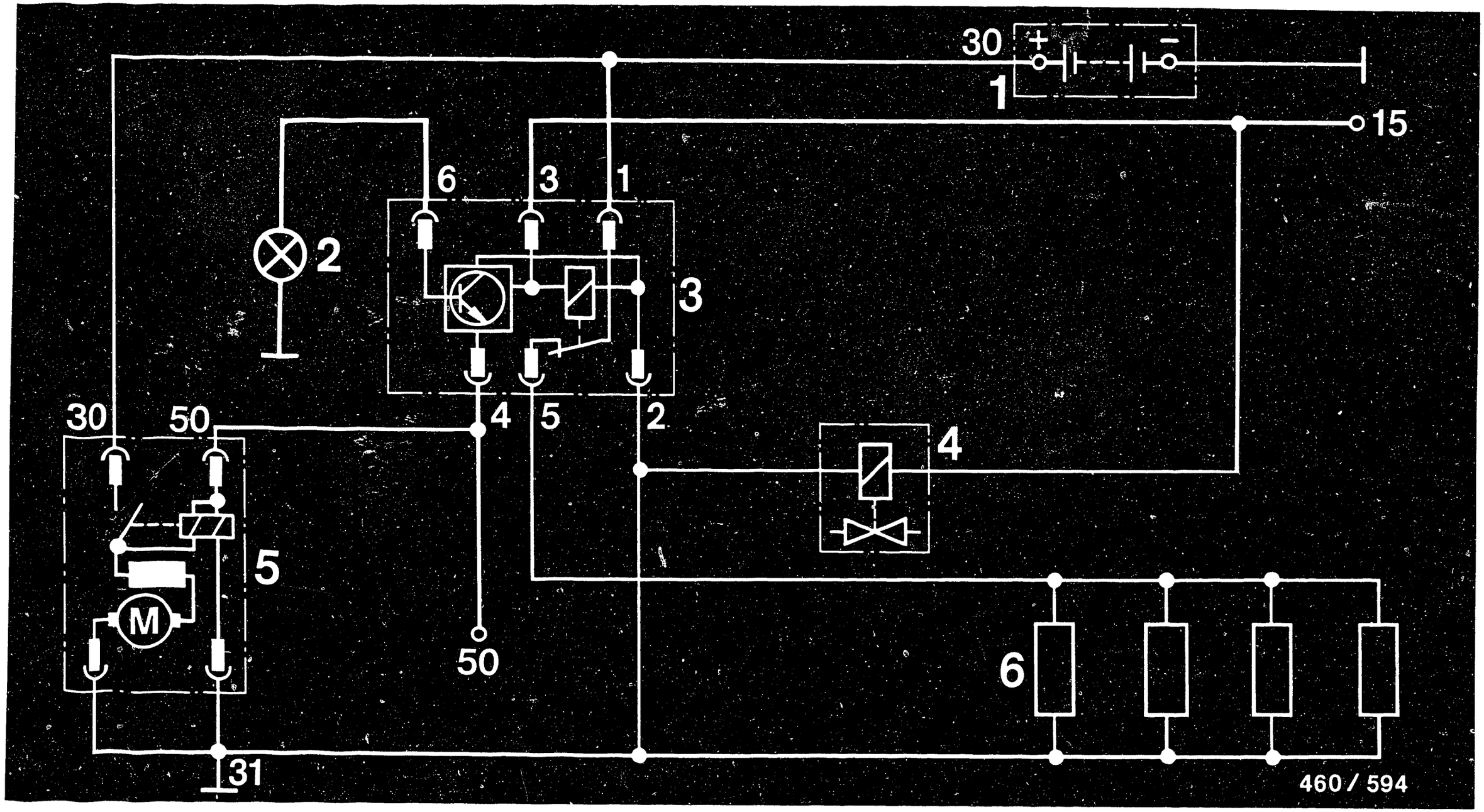
1. Test specifications

1.1 Idle speed:	800...850 min^{-1}
Fast idle	1250...1300 min^{-1}
1.2 Nozzle opening pressure:	130 + 5 bar
1.3 Injection timing:	
Check value Engine setting:	4th cylinder 0.69...0.75 mm BTDC
Setting value Engine setting:	4th cylinder 0.72 mm BTDC
Check value Pump setting:	0.28...0.32 mm ABDC
Setting value Pump setting:	0.30 mm ABDC
1.4 Compression pressure:	25...30 bar
max. cylinder deviation:	5 bar

1.5 Tightening torques

Fuel lines	25 Nm
Injection-pump fastening screws	20 Nm
Nozzle-holder assembly fastening screws	70 Nm
Sheathed-element glow plugs	25 Nm
Injection-pump support bracket	20 Nm
Screw plug	15 Nm
Rocker arm adjusting screw	15 Nm
Crankshaft pulley fastening nut	170 Nm
Cylinder head cover screws	7.5 Nm

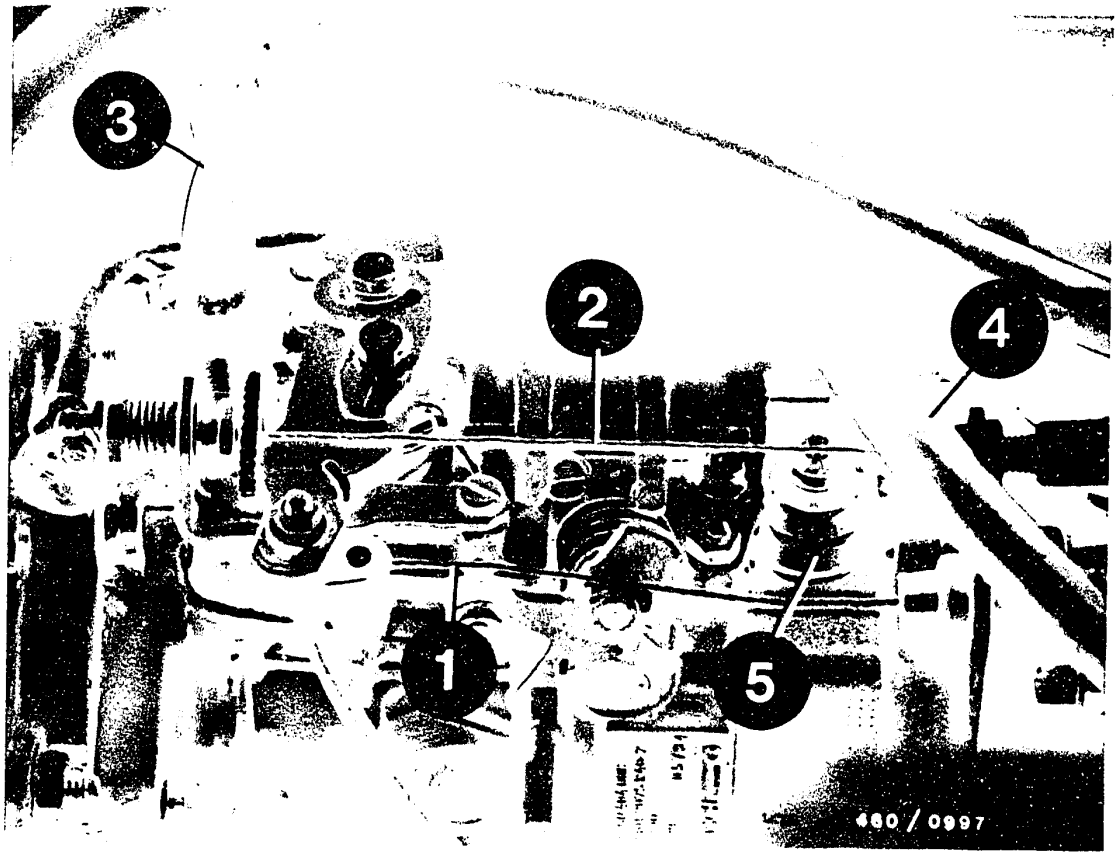


1 = Battery
2 = Glow plug indicator lamp (12 V max. 2 W)
3 = Glow-duration unit
4 = Solenoid-operated valve
5 = Starting motor
6 = Glow plugs

2. Terminal diagram for preheating system

3. Test equipment and tools

Designation	Part number	Use
Peugeot tool	8.0105 Y	Taking out the valve spring
Box wrench	KDEP 1115	Releasing/tightning fuel-inj. lines
Tester	KDEP 2991	Injection timing
Tester	KDEP 1085	Injection timing
Mini-dial indicator 1/100 mm	commercially avail., e.g., Hahn&Kolb 7000 Stuttgart Part No. 33 003 with adapter KDEP 1127	Injection timing
Tachometer	commercially avail., e.g., Dr.E. Horn Gmbh Meßgerätefabrik Postfach 40 7036 Schoenaich Part dec.: HT 446 (with digital reading)	Adjusting engine speed



4. Taking out the fuel-injection pump

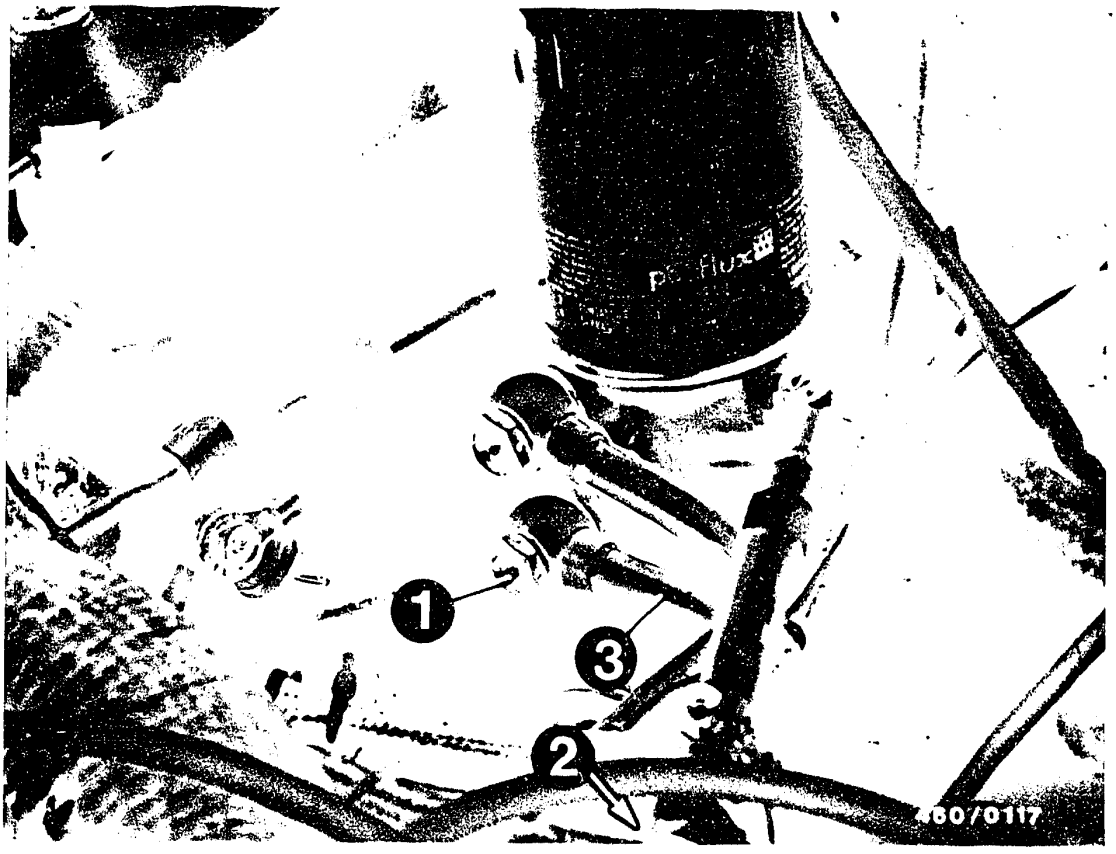
Disconnect the negative lead from the battery.

Remove the cable on the control lever of the fuel-injection pump (1), the cable for fast idle (2), the fuel supply line (3), the fuel return line (4), and the lead for the shutoff device (5).

Release the fuel-injection lines (1) using open box wrench KDEP 1115. (Prevent the delivery-valve holder from becoming loose by holding it with a wrench).

Remove the support bracket (2) on the distributor body and the fastening screws of the fuel-injection pump.

Take the pump off the motor, being careful of the seal.



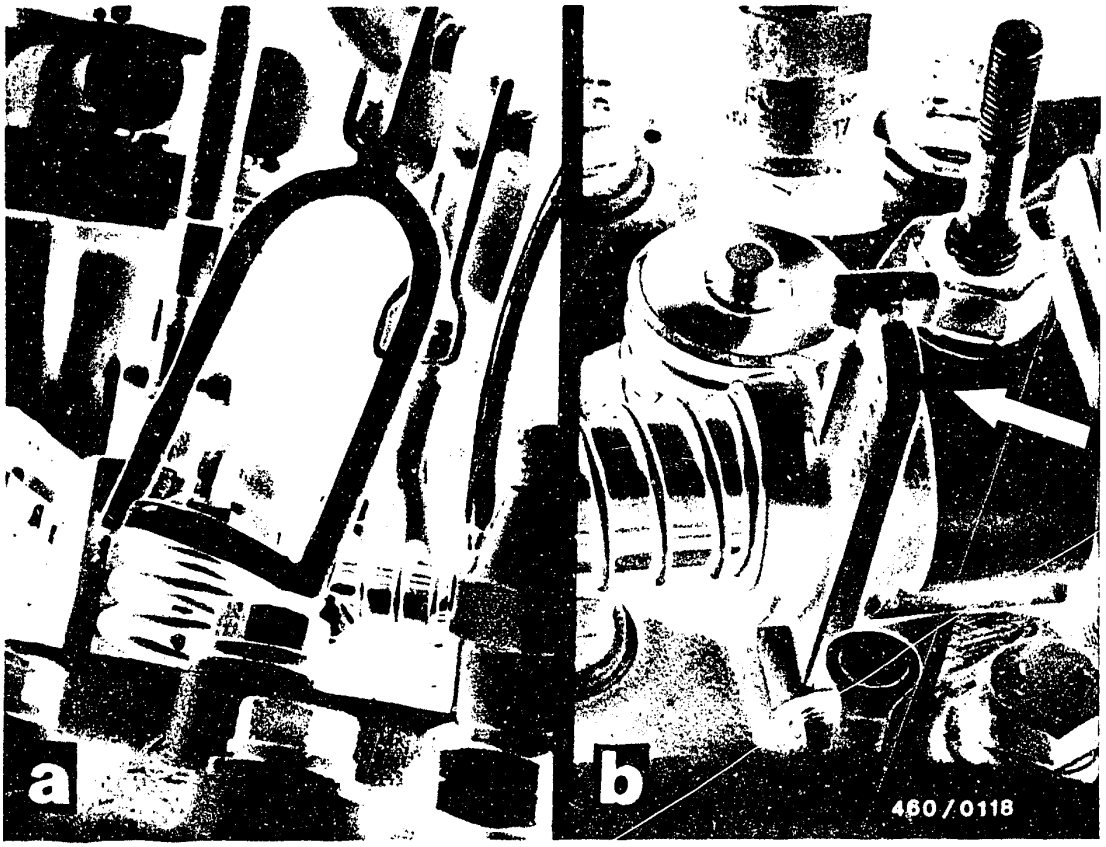
5. Putting in the fuel-injection pump

Turn the crankshaft using the box wrench.

Remove the cylinder head cover.

Unscrew the bottom fastening screw (1) on the oil filter and the screw (2) on the oil cooler.

Lay the line (3) to one side.

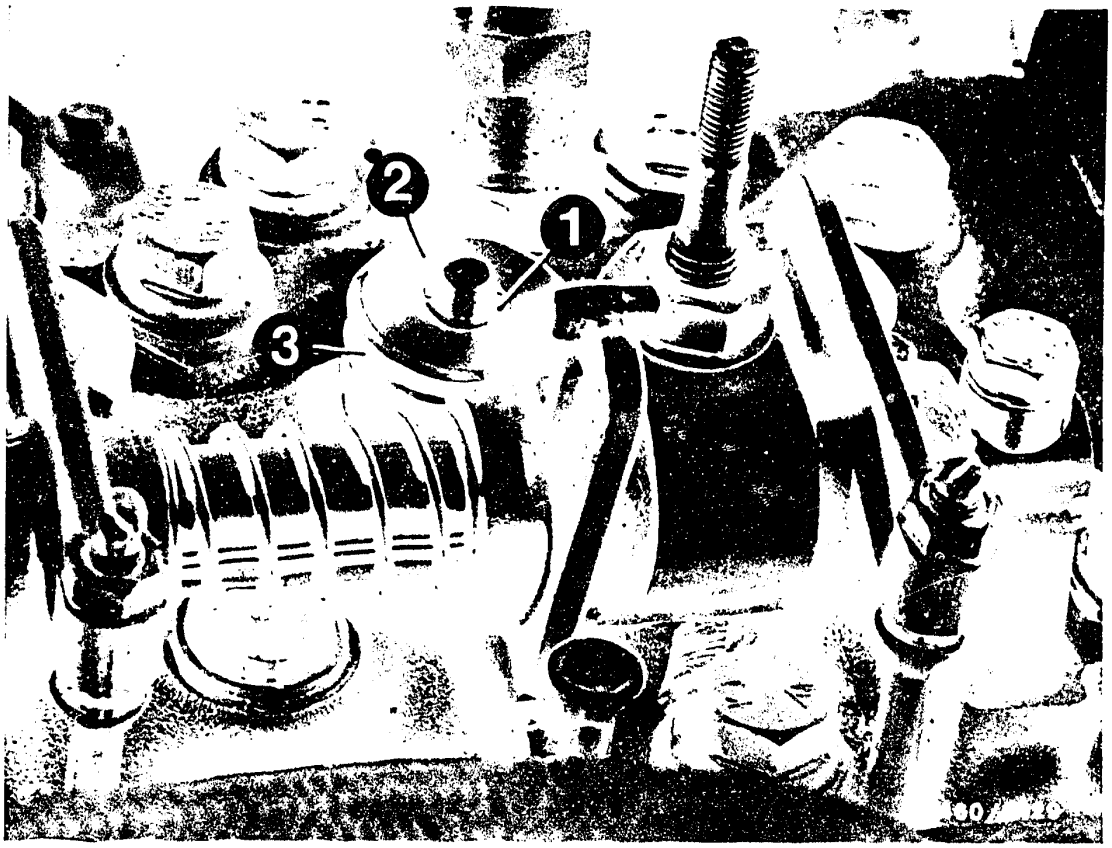


Turn crankshaft so that exhaust valve just opens with cylinder 1 in BDC position.

Hook tool 8.0105 Y into rocker arm shaft and force exhaust valve spring on cylinder 4 downward (picture, a).

Move rocker arm against compression spring on rocker arm shaft and place vertically.

In this position bring into starting position (picture, b).



Turn crankshaft in engine direction of rotation until cylinder 4 is at TDC.

The valves of cylinder 1 are on overlap.

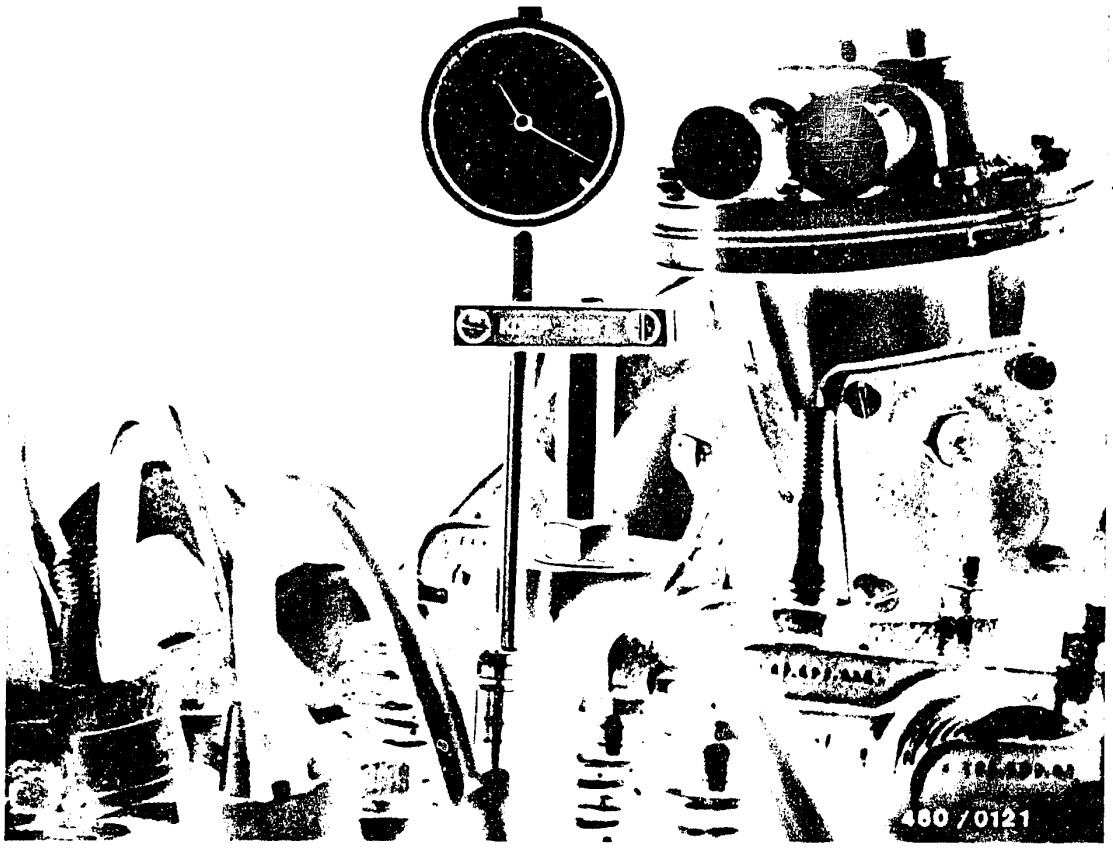
Press exhaust valve spring of cylinder 4 downward using tool 8.0105 Y.

Remove collets (1) from exhaust valve.

Relax valve spring, and remove spring plate (2) and valve spring (3) from valve.

The 4th cylinder discharge valve now touches against the engine plunger.

Take out the sheathed-element glow plugs of the 3rd and 4th cylinders.



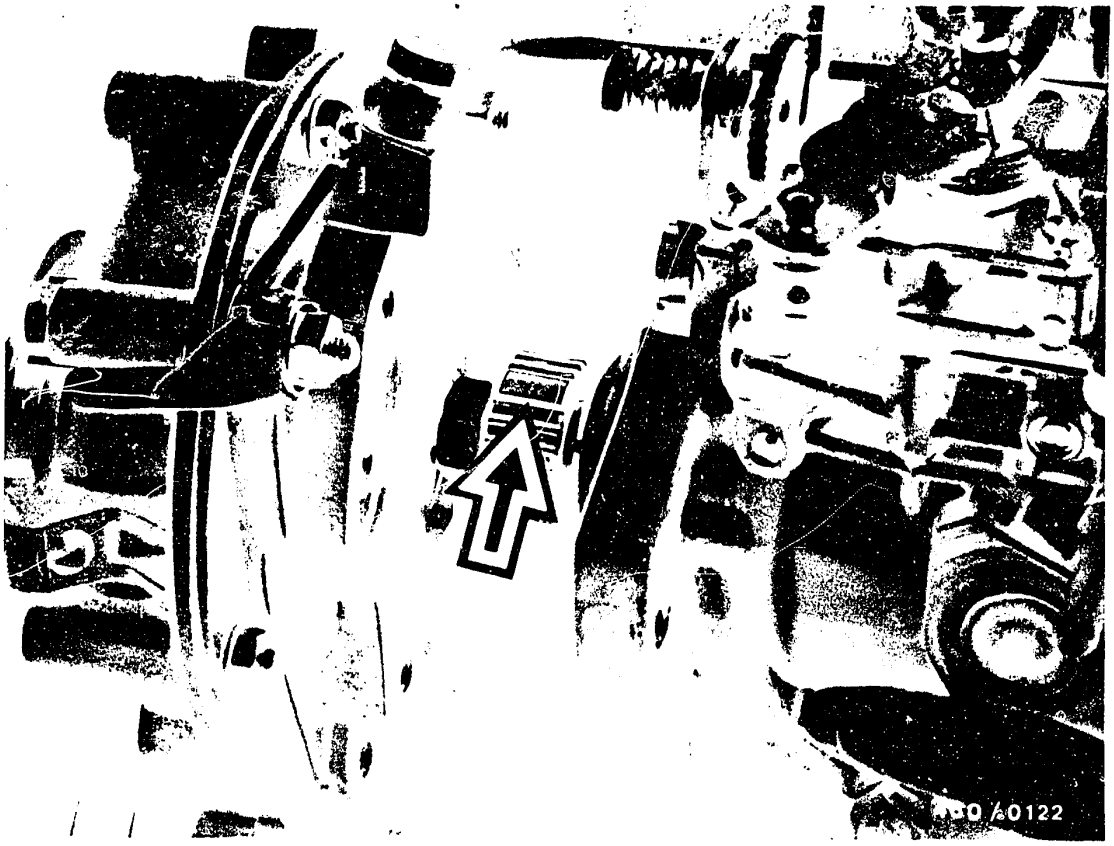
Screw measuring tool KDEP 2991 onto threaded pin of cylinder 4.

Fit dial indicator 1 687 233 012 with long measuring base into measuring tool KDEP 2991.

The measuring base rests on the exhaust valve of cylinder 4. Preload dial indicator by approx. 10 mm.

Turn crankshaft against engine direction of rotation until piston has covered a stroke of approx. 7 mm.

Turn crankshaft back in engine direction of rotation until cylinder 4 is at TDC.
Set dial indicator to "0".

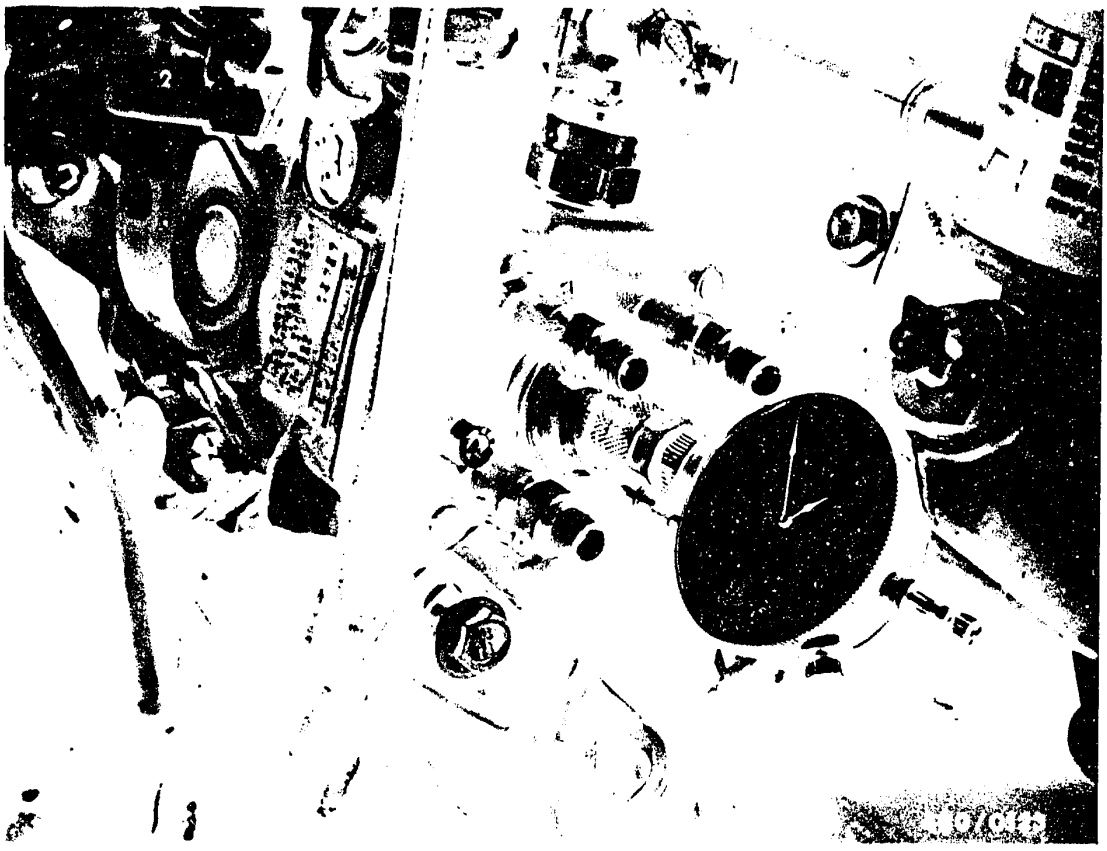


Turn injection-pump drive shaft so that mark on drive pinion points approximately toward outlet "B" (see picture, arrow).

Stick new paper gasket with grease onto mounting flange for injection pump.

Introduce injection pump into engine plug-in sleeve.

Provisionally tighten fastening screws (with hexagon socket head) of injection pump.



Remove bleeder screw from central screw plug (triangular plug) of injection pump.

Screw measuring tool KDEP 1085 into bore for bleeder screw.

Mount dial indicator 1 687 233 011 or .. 012 with measuring base and preload by approx. 3 mm.

Turn crankshaft against engine direction of rotation until dial indicator indicates BDC position of injection pump plunger.

Set dial indicator to 0.

Turn the crankshaft in the direction of engine rotation until the dial indicator on the discharge valve of the 4th cylinder indicates a plunger stroke of 0.72 mm BTDC.

With the indicated plunger setting, the dial indicator on the fuel-injection pump must show a pump plunger stroke of 0.28...0.32 mm ABDC.

If need be, adjust the stroke by pivoting the fuel-injection pump. To do this, the fastening screws for the fuel-injection pump (also on the support bracket) must be released.

Then tighten the fastening screws again to 20 Nm.

Checking the setting of the fuel-injection pump with regard to the engine.

Turn the crankshaft in the direction of engine rotation until the dial indicator on the fuel-injection pump indicates a stroke of 0.30 mm.

In this setting, the plunger of the 4th cylinder must stand 0.69...0.75 mm BTDC.

Align the support bracket on the distributor body of the fuel-injection pump in such a way that it touches up against the cylinder block and the distributor body without stress.

Screw the support bracket down tight.

Put on the fuel-injection pump control-lever cable, the cable for fast idle, the fuel delivery and return lines, and the lead for the electrical shutoff device.

Note:

It is not permissible to exchange the inlet-union screws of the fuel delivery and return lines, one for the other.

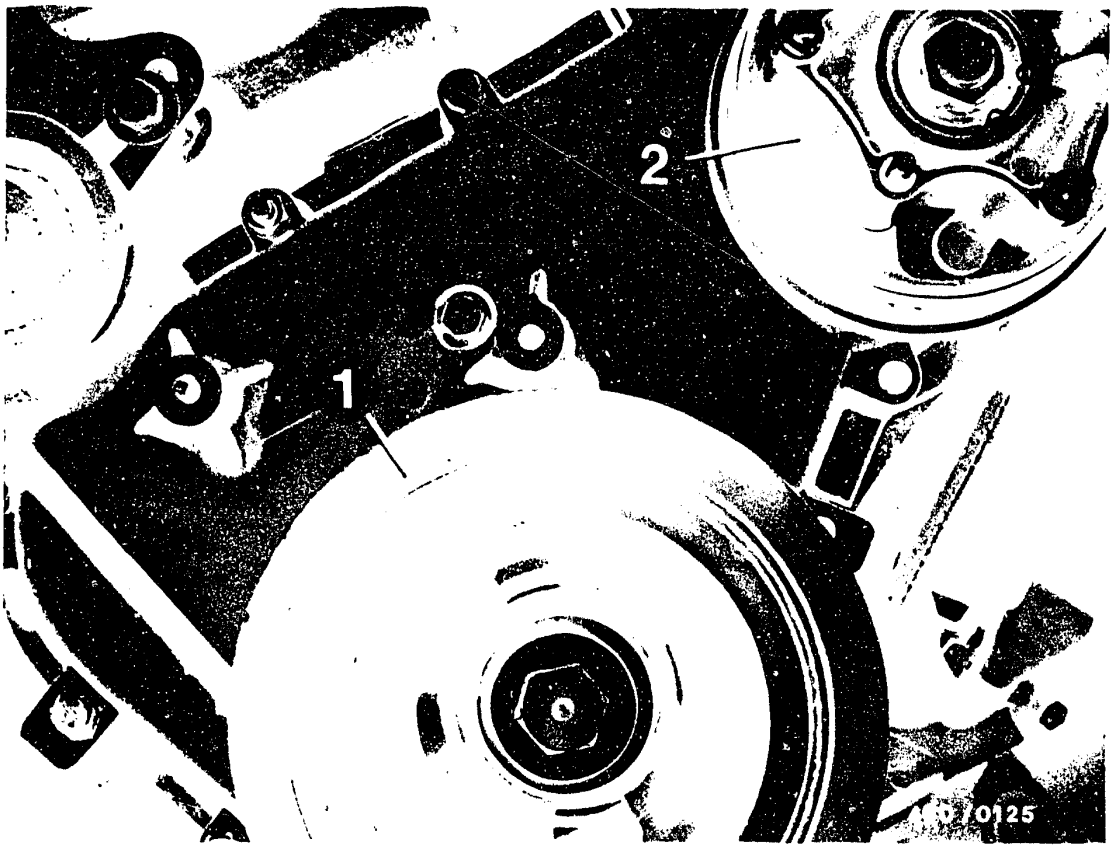
The inlet-union screw of the return line has throttle bores and is marked on the head of the screw with the word "Out".

Tighten the fuel-injection lines using open box wrench KDEP 1115. (Prevent the delivery valve holder from turning by holding it with a wrench).

Put on the line from the oil cooler to the oil filter and the cylinder head cover.

Put in the sheathed-element glow plugs of the 3rd and 4th cylinders.

Connect the negative lead to the battery.



6. Checking and adjusting engine timing

6.1 Checking engine timing

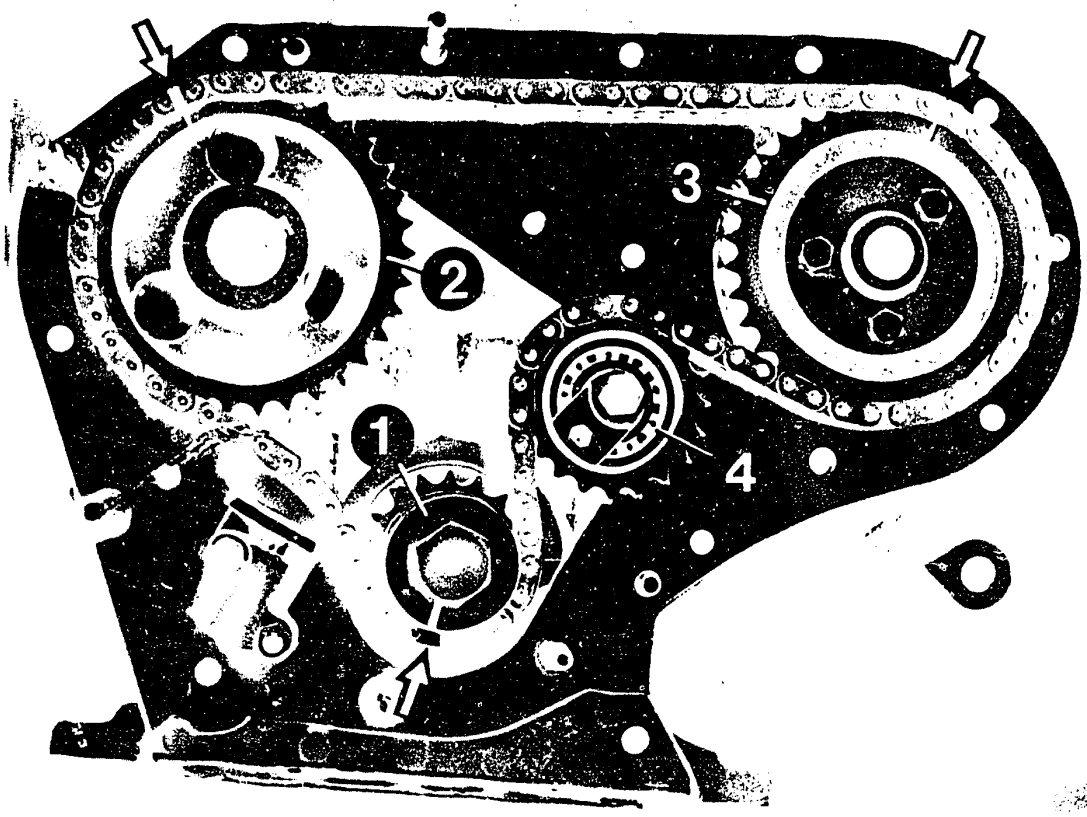
Take out the fan.

Remove crankshaft pulley (1) and fan wheel (2).

Remove V-belt for fan wheel and crankshaft pulley.

Remove timing cover.

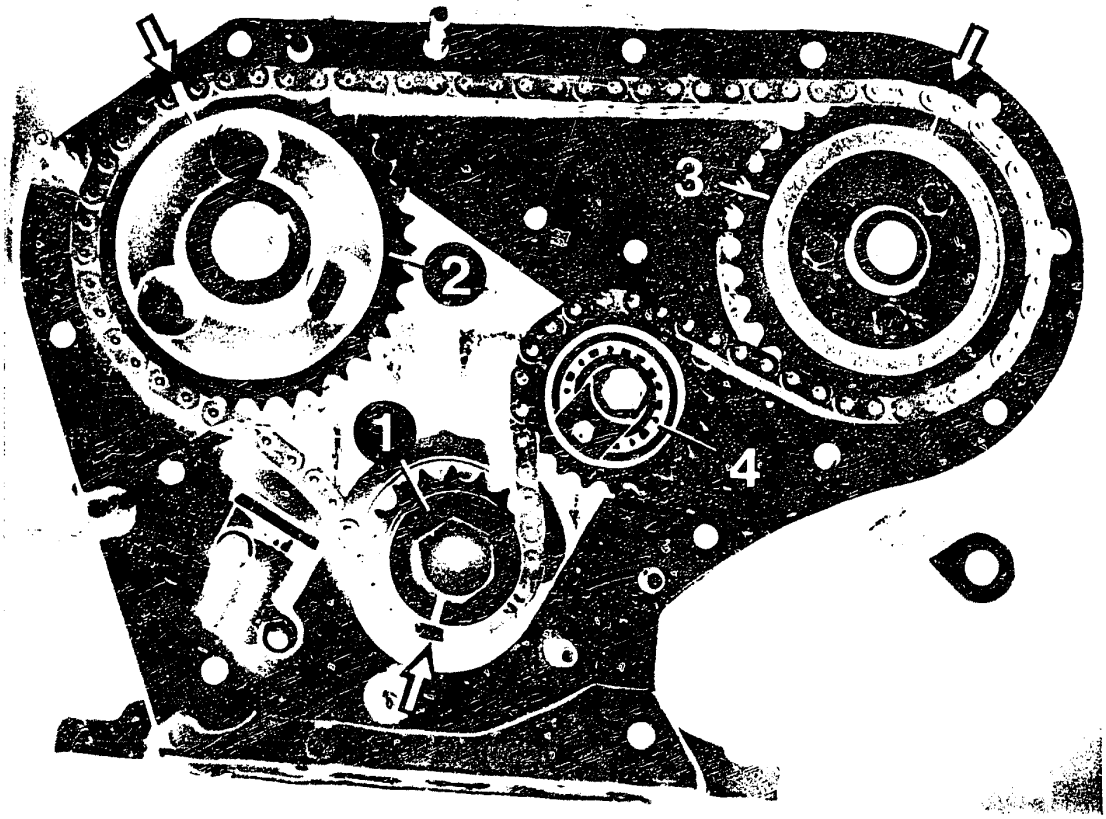
Screw crankshaft pulley fastening screw into crankshaft gear.



Using crankshaft gear (1), turn crankshaft in engine direction of rotation until the following marks are in alignment:

- Mark on crankshaft gear (1) and copper link in chain (arrow).
- Line marks on camshaft gear (2) and chain (arrow).
- Line marks on injection-pump drive gear (3) and chain (arrow).

If marks are not in alignment, adjust engine timing.

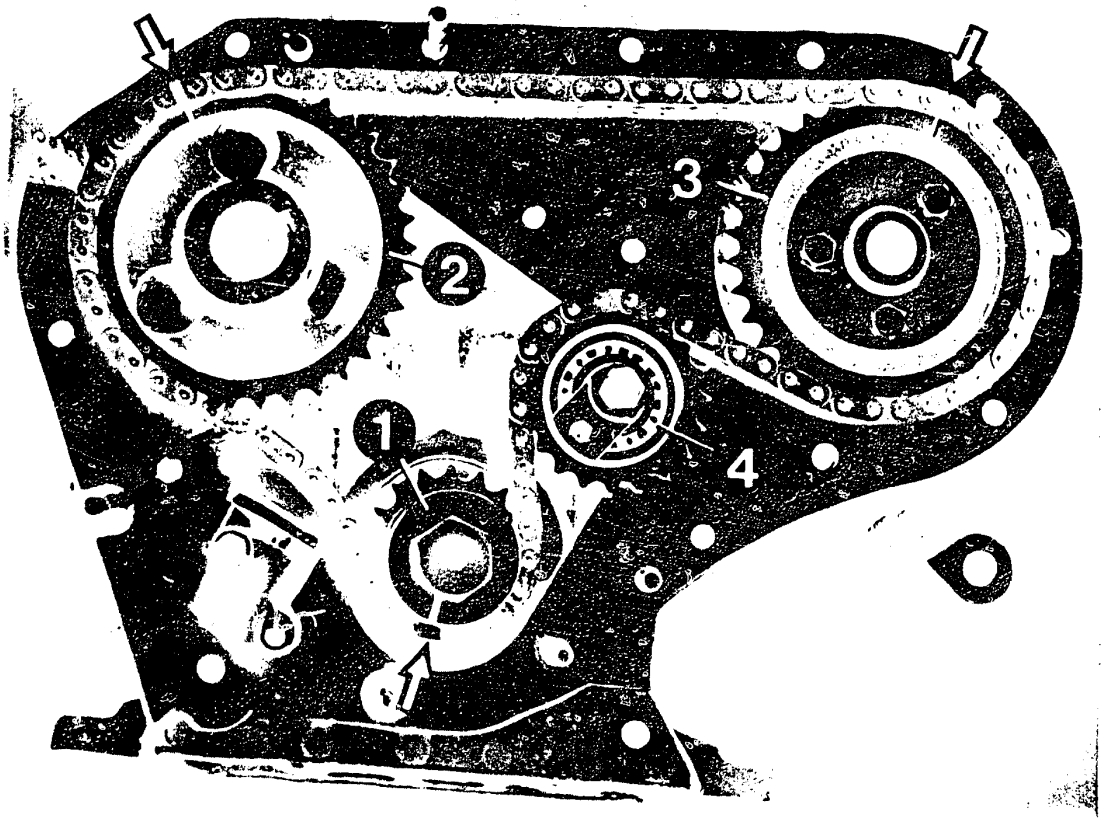


If marks are in alignment, remove hexagon screw from crankshaft gear (1).

Mount timing cover.

Install crankshaft pulley and fan wheel with V-belt.

Put on the fan.



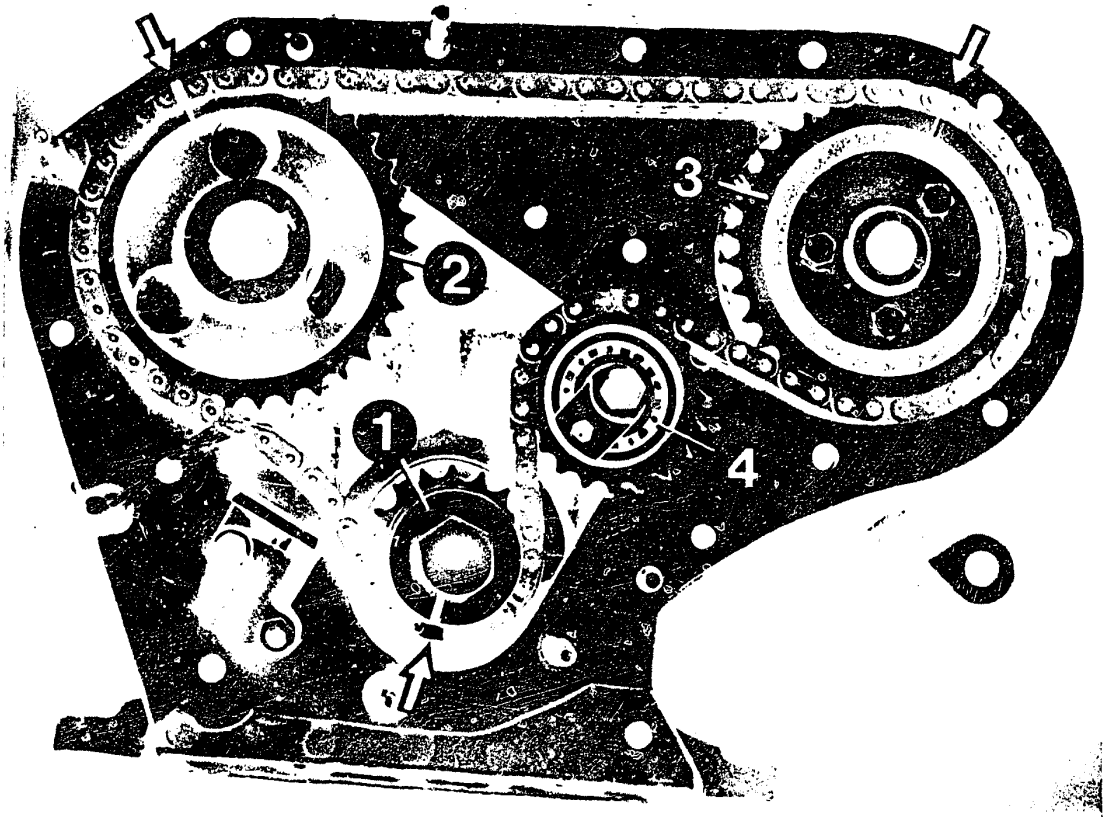
6.2 Adjust engine timing

Relax chain tensioner using 3 mm Allen wrench. To do this, remove plug.

Loosen fastening screw of idler gear (4) and pivot eccentric to the right until timing chain is relaxed.

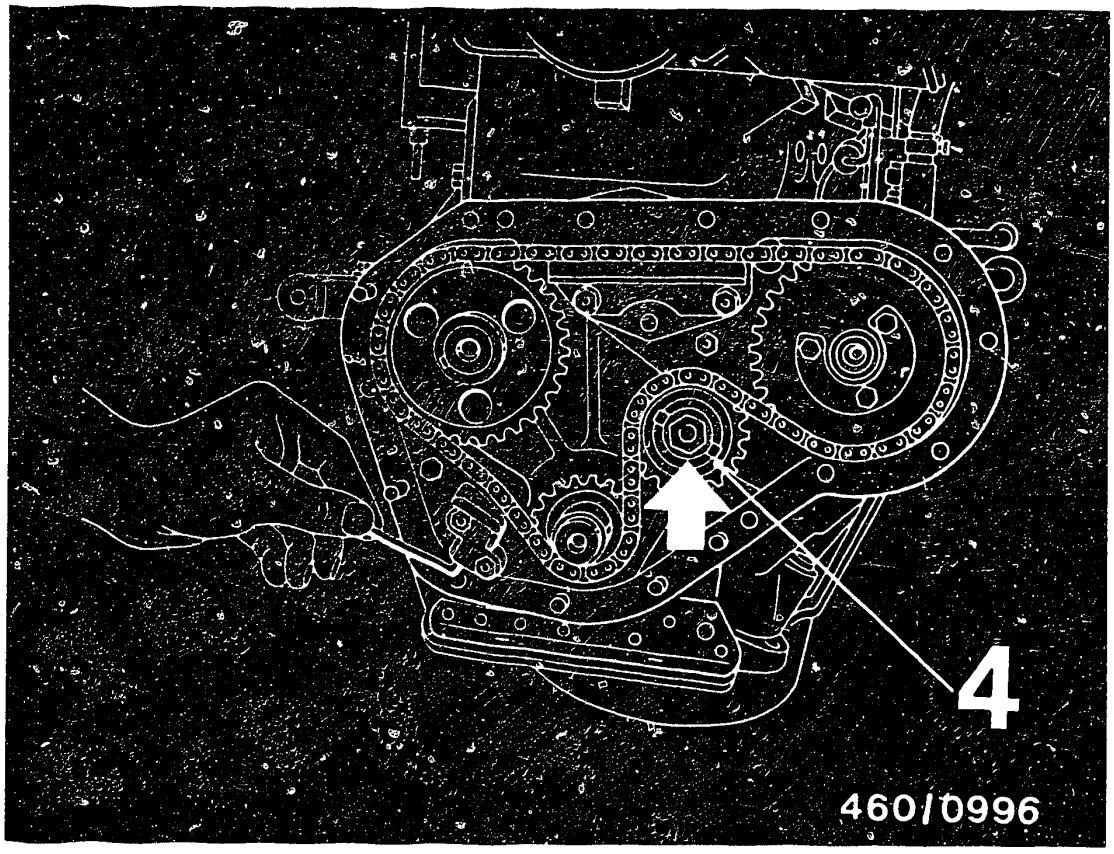
Remove timing chain.

Bring crankshaft gear (1), camshaft gear (2) and injection-pump gear (3) into the correct position with respect to the marks (arrows), see picture.



Place timing chain on crankshaft gear (1) so that copper link is against punch mark (arrow).

When placing the timing chain on the other gears, make sure that line marks on timing chain and gear are in alignment (arrows).

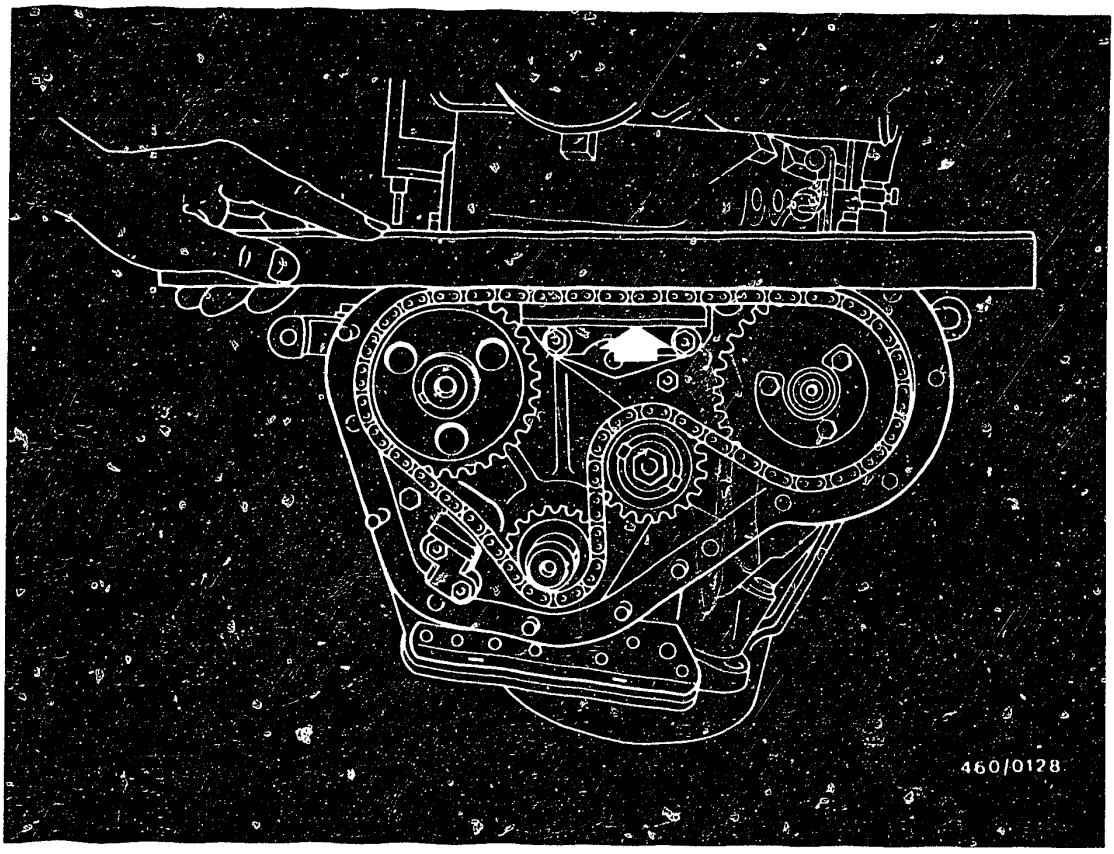


Pivot the intermediate gear (4) to the left counter to the direction of engine rotation until there is a gap of from 0.5...1.0 mm between the shoe of the chain tensioner and its bracket.

Tighten the fastening screw for the intermediate gear (arrow) to 50 Nm.

Prestress the spring on the chain tensioner using a hexagon-socket-screw key until the control chain lies up tight against the shoe.

Put the screw plug on the chain tensioner.



Lay rule over camshaft gear and pump gear.

Bring guide shoe (arrow) up against timing chain and tighten fastening screws.

If still mounted, remove hexagon screw from crankshaft gear.

Mount timing cover.

Install crankshaft pulley and fan wheel with V-belt.

Newer models of engine have no shoe (arrow).
After re-adjusting the engine timing, check the injection-timing and if need be adjust it.

Table of contents

1. Special features

This microcard contains the trouble-shooting instructions to Mercedes-Benz vehicles type 201
200D, 2.0l 4 Cyl. EU (Mot. 601) 9.83 →
200D, 2.2l 4 Cyl. USA (Mot. 601) 9.83 →
250D, 2.5l 5 Cyl. EU (Mot. 602) 4.85 →
250D, 2.5l 5 Cyl. USA (Mot. 602) 8.85 →
with fuel-injection pump M.. and RSF II governor

Detailed basic instructions: MB 511

2. Test specifications

2.1 Idle-speed of pumps with electronic idle-speed control

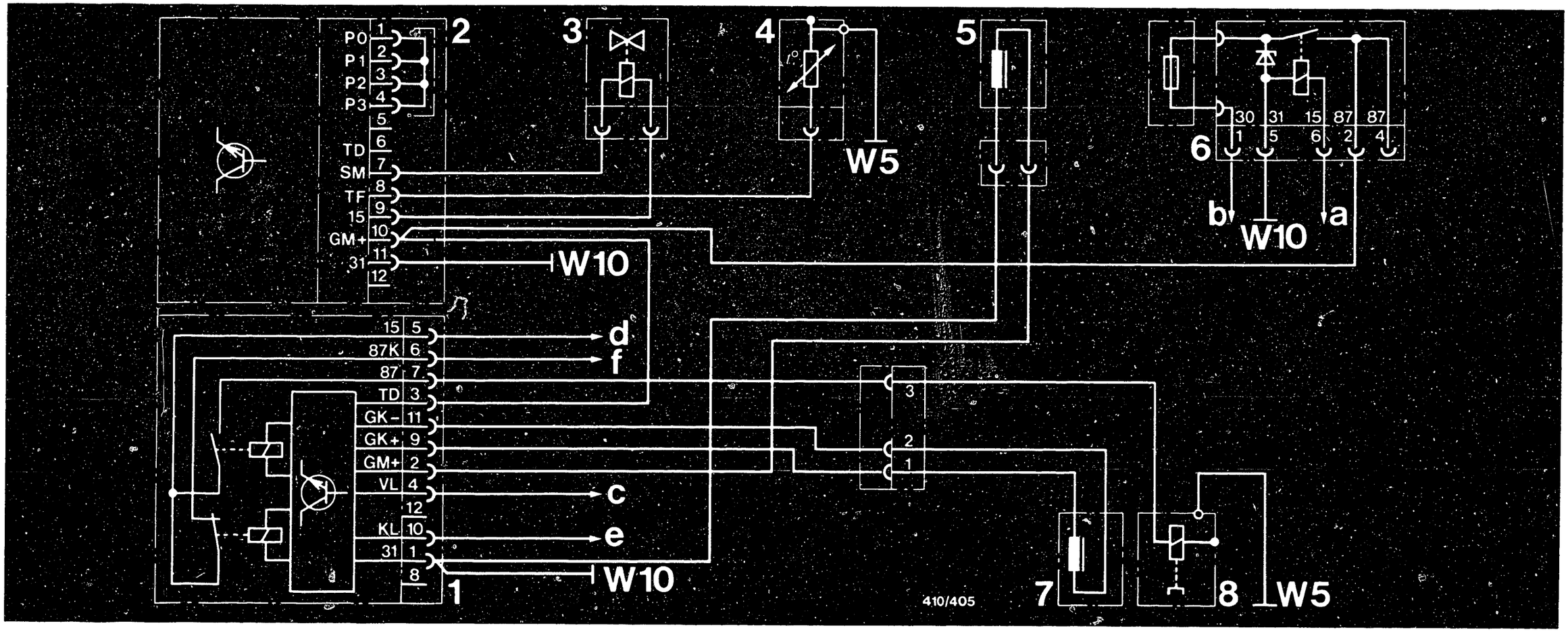
Engine	Idle-speed with control	without control
601	720 ± 20	660 ± 40
602	680 ± 20	620 ± 40

2.2 Tightening torques

Fuel-injection tubing	10 - 20 Nm
Fuel-injection-pump flange	20 - 25 Nm
Central fastening screw to timing device (left-hand thread)	40 - 50 Nm
Screw plug to governor for dynamic start-of-delivery setting	30 - 35 Nm
Nozzle-and-holder assembly	70 - 80 Nm
Delivery-valve holder	35 Nm
Nozzle-retaining nut	70 - 90 Nm
Fastening screw, blower	25 Nm
Rod-type glow plugs	20 Nm
Chain tensioner	80 Nm

3. Test equipment and tools

Designation	Part number	Application
Test resistance 2.5 kΩ	102 589 056 300 (D.B. establishment)	Check temperature sensor
TDC sensor Engine 601 Engine 602	601 589 042 100 (D.B. establishment) 603 589 002 100	Adjust idle speed
Diesel-engine tester and adapter lead special accessory: Governor-pulse generator TDC sensor Engine 601 Engine 602 MOT 300 and adapter lead	ETD 019.00 1 684 463 147 617 589 102 100 601 589 042 100 (D.B. establishment) 603 589 002 100 (D.B. establishment) 1 684 463 094	Adjust idle speed
Tachometer (photoelectric) Extractor tool	Commericially available KDEP 1573	Adjust idle speed Disconnect servo magnet



1 = Control unit, refrigerant compressor
2 = Control unit, idle-speed control
3 = Servo magnet, fuel-injection pump
4 = Coolant temperature sensor
5 = Engine-speed sensor
6 = Over-voltage protection
7 = Engine-speed sensor, refrigerant compressor
8 = Electromagnetic clutch, refrigerant compressor

a = Central electrics clutch U-socket 5
b = Multiple butt connector, engine term. 30
c = Microswitch
d = Central electrics clutch W-socket 2
e = Pressure switch, refrigerant compressor
f = Kickdown switch
W5 = Ground, engine
W10 = Ground, battery

4. Check electronic idle-speed control

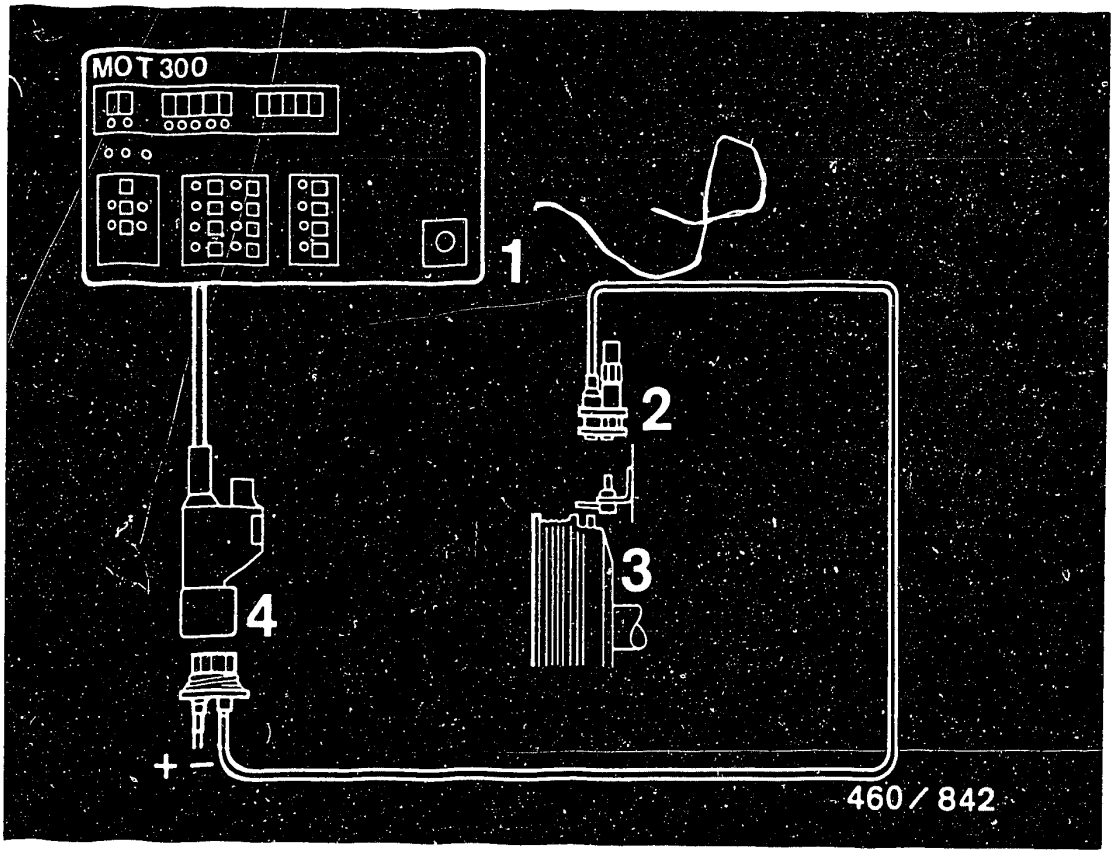
4.1 Diagram of electronic idle-speed control, vehicle with automatic transmission and air conditioner

4.2 Description of operation of electronic idle-speed control

The engine-speed sensor registers the engine speed (144 pulses/revolution) and transmits this on to the refrigerant-compressor control unit in the form of an AC voltage.

The control unit of the idle-speed control receives the converted engine-speed signal, compares the set and instantaneous values and transmits corresponding pulses to the servo magnets at the fuel-injection pump. In this way, the idle speed is kept constant independant of the loading of the engine.

When the coolant temperature is below +60°C, the idle-speed set value is raised by the temperature sensor in accordance with a specified map.



1 = Test device
2 = TDC sensor
3 = Pulley
4 = Adapter lead

4.3 Terminal diagram for testing the electronically controlled idle speed with MOT 300 or diesel tester

Required test equipment:

TDC sensor, engine 601, DB Part No.: 601 589 042 100
TDC sensor, engine 602, DB Part No.: 603 589 002 100
Adapter lead to MOT 300,
Bosch Part No.: 1 684 463 094
Adapter lead to diesel tester
Bosch Part No.: 1 684 463 147

Note:

If there is no TDC sensor, measure the engine speed using a commercially available tachometer (e.g. photoelectric).

4.3.1 Test conditions

- Battery voltage at least 11.5 V
- Selector lever for automatic transmission in position "P"
- Air conditioner switched off
- Bowden cable must be in contact with the reverse-transfer lever, tension-free
- Engine-coolant temperature > 60 °C

4.3.2 Test procedure

Engine runs at idle.
Controlled idle-speed set value:
Engine 601:
700 ... 740 min^{-1}

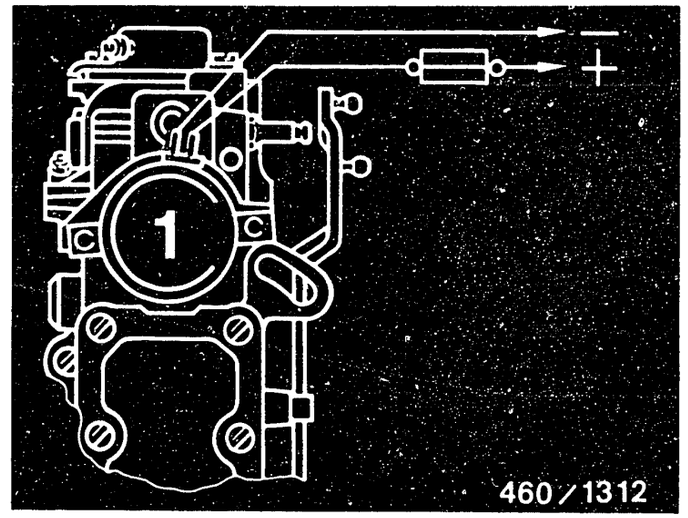
Engine 602:
660 ... 700 min^{-1}

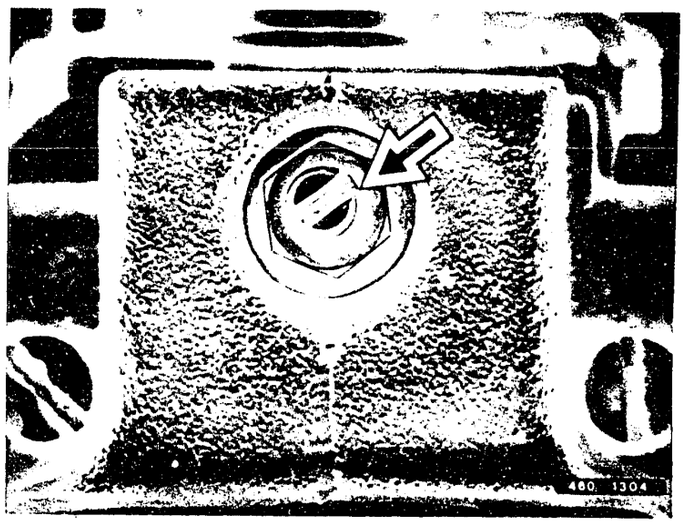
Idle speed correct?

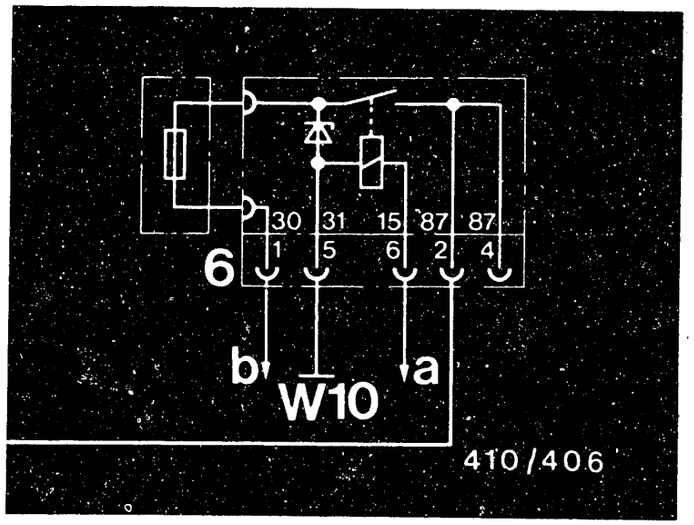
no →

Test step 1: (Check servo magnet)
1. Disconnect plug at servo magnet at fuel-injection pump. Reconnect plug. Engine speed must now increase. If engine speed does not increase, connect 12 V to servo magnet (only for short time approx. 3 s., otherwise servo magnet defective) (see upper illustration). If idle speed still does not increase, servo magnet defective - replace. Use extractor tool KDEP 1573 for removal/installation and pay attention to adjustment washers.
2. Check uncontrolled idle speed (plug at servo magnet disconnected):
Engine 601: 602 ... 700 min^{-1}
Enigne 602: 580 ... 660 min^{-1}
Adjust idle speed if necessary at adjusting screw of fuel-injection pump after loosening lock nut (see arrow, central illustration).
Test step 2: (Check over-voltage protection)
1. Engine switched off. Switch on ignition. Check using voltmeter whether approx. battery voltage is present at the two contacts of the fuse at the over-voltage protection. Replace defective fuse.
2. Check for short circuit in lead of multiple butt connector, engine term. 30, lead from plug connection, engine socket 1 (12-pin) term. 15 and lead from battery ground, in each case to over-voltage protection term. 1, 6 and 5 (see lower ill.). Eliminate short circuit. If no defect found in Point 1 and no short circuit in Point 2, replace over-voltage protection.
3. Check for short circuit in lead from over-voltage protection term. 2 to electronic-idle-speed-control control unit term. 10. Eliminate short circuit.

yes →







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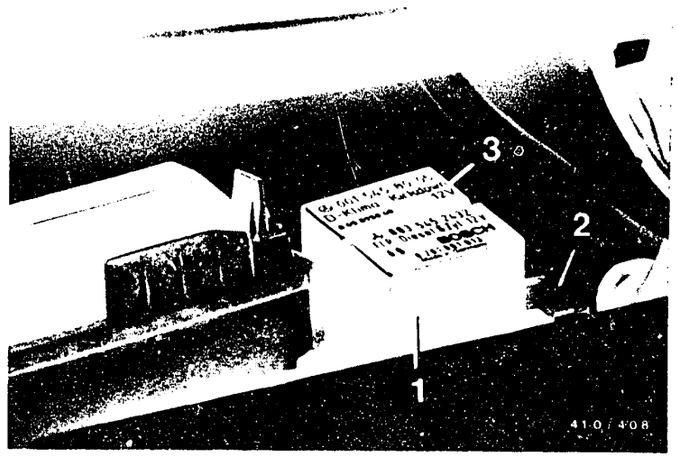
4. Disconnect electr.-idle-speed-control control unit (1). Check for short circuit in leads from electr.-idle-speed-contr. contr. unit base term. 11 to battery ground, from term. 7 to servo magnet, from term. 8 to coolant temperature sensor, from term. 10 and 12 to speed sensor, from term. 9 to over-voltage prot. term. 2. Eliminate short circuit.

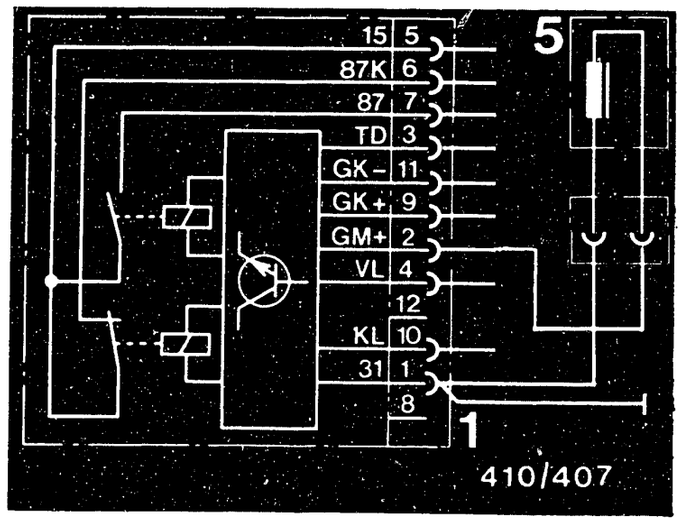
Test step 3: (Check electr. drive of servo magnets).
Connect electr.-idle-speed-contr. contr. unit (1). Engine runs at idle. Disconnect plug from servo magnet and check voltage at plug.
Reading, desired: approx. 12 V
If voltage not obtained, replace electr.-idle-sp. contr. contr. unit.

yes

Test step 4: (Check speed sensor)
1. Engine switched off. Disconnect contr. unit (refrig. compr.). Measure resistance of speed sensor at plug base between sockets 1 and 2.
Reading, desired: 1.9 ± 0.2 kΩ
If reading outside tolerance, replace speed sensor (seated at flange to transmission).
2. Run engine at idle (control unit disconnected). Measure AC voltage at plug base between sockets 1 and 2. Reading, desired:
Engine 601: > 4V ~ at 660 ± 40 min^{-1}
Engine 602: > 4V ~ at 620 ± 40 min^{-1}
With increasing speed = increasing voltage (~).
If voltage not obtained, replace speed sensor.



1 = Electr.-idle-speed-control control unit
2 = Over-voltage protection
3 = Control unit (refrigerant compressor)



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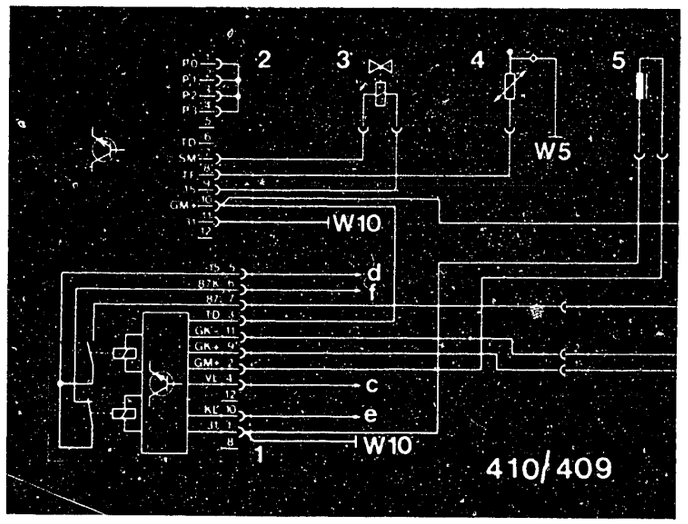
Test step 5: (Check TD input signal)
1. Disconnect electr.-idle-sp.-contr. contr. unit. Run engine at idle. Measure AC voltage at plug base between sockets 10 and 11.
Test values, desired:
Motor 601: > 2.8V ~ at 660 ± 40 min^{-1}
Motor 602: > 2.8V ~ at 620 ± 40 min^{-1}

If voltage value is not obtained, switch off engine and check for short circuit in lead from control unit (refrig. compressor) socket 3 to electr.-idle-sp.-contr. control unit socket 10. Eliminate short circuit.
2. Switch on ignition. Disconnect control unit (refrigerant compressor). Measure using voltmeter between socket 1 and 5.
Reading, desired: approx. 12V
If reading not obtained, replace control unit (refrigerant compressor). If value not obtained, eliminate short circuit.



1 = Control unit (refrigerant compressor)
2 = Electr.-idle-speed-control control unit
3 = Servo magnet (fuel-injection pump)
4 = Coolant temperature sensor
5 = Speed sensor

yes

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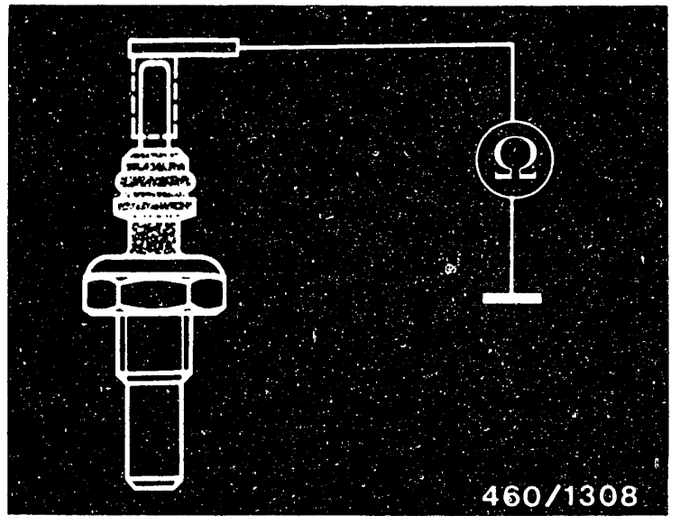
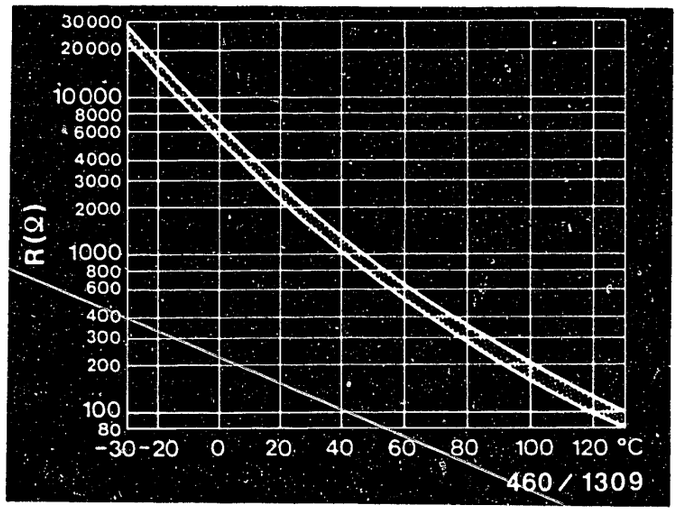
Test step 6: (Check temperature sensor)
1. Run engine at idle. Disconnect plug at coolant temperature sensor.
With a test resistance (fixed resistance 2.5 kΩ) between plug and ground, simulate coolant temperature of + 20 °C. Engine speed must increase. Otherwise temperature sensor defective - replace.

2. Engine switched off.
Check internal resistance of temperature sensor using ohmmeter to ground (see upper illustration).
Set value, see diagram.
Example:
+20°C 2.2 ... 2.8 kΩ
+80°C 290 ... 370 Ω
If set values not obtained, replace temperature sensor.





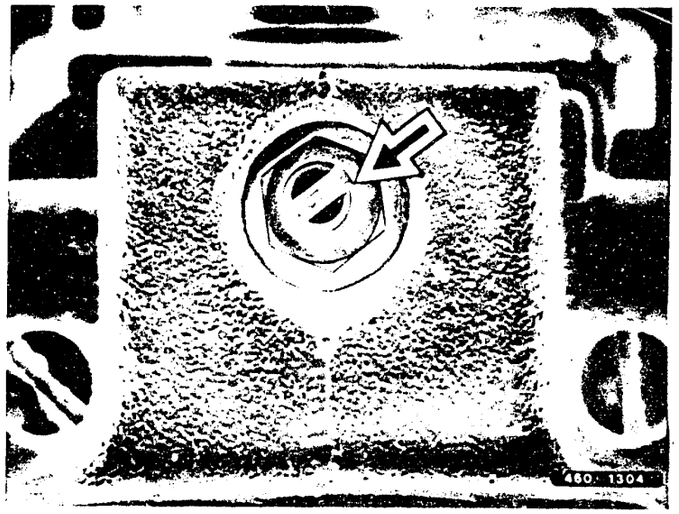
Check uncontrolled idle speed.
Disconnect plug at servo magnet.
Idle speed uncontrolled.
Desired:
Engine 601:
620 ... 700 min^{-1}
Engine 602:
580 .. 660 min^{-1}

Idle speed correct?

no → Adjust idle speed at adjusting screw of fuel-injection pump (see arrow, lower illustration) after loosening the lock nut.

yes ↓

Check completed.
Electronic idle-speed-control
O.K.



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SPECIAL FEATURES

This microcard contains the trouble-shooting instructions for the diesel fuel-injection system, valid at the time of publication, for the following vehicles:

Renault 9D (1.83 ->), 11D (7.83 ->)

1. Test specifications

1.1	Idle speed:	850 ± 25 min^{-1}
	Fast idle	1150 ± 50 min^{-1}
1.2	Nozzle-opening pressure	130 + 8 bar
1.3	Coordination, pump - engine (F 8 M):	
	Engine position:	1st cylinder at TDC
	Check value:	
	Pump position:	0.63...0.67 mm after BDC
	Setting:	
	Pump position:	0.65 mm after BDC
1.4	Compression:	at least 20 bar
	Max. cylinder deviation:	4 bar

1.5 Cold-start device

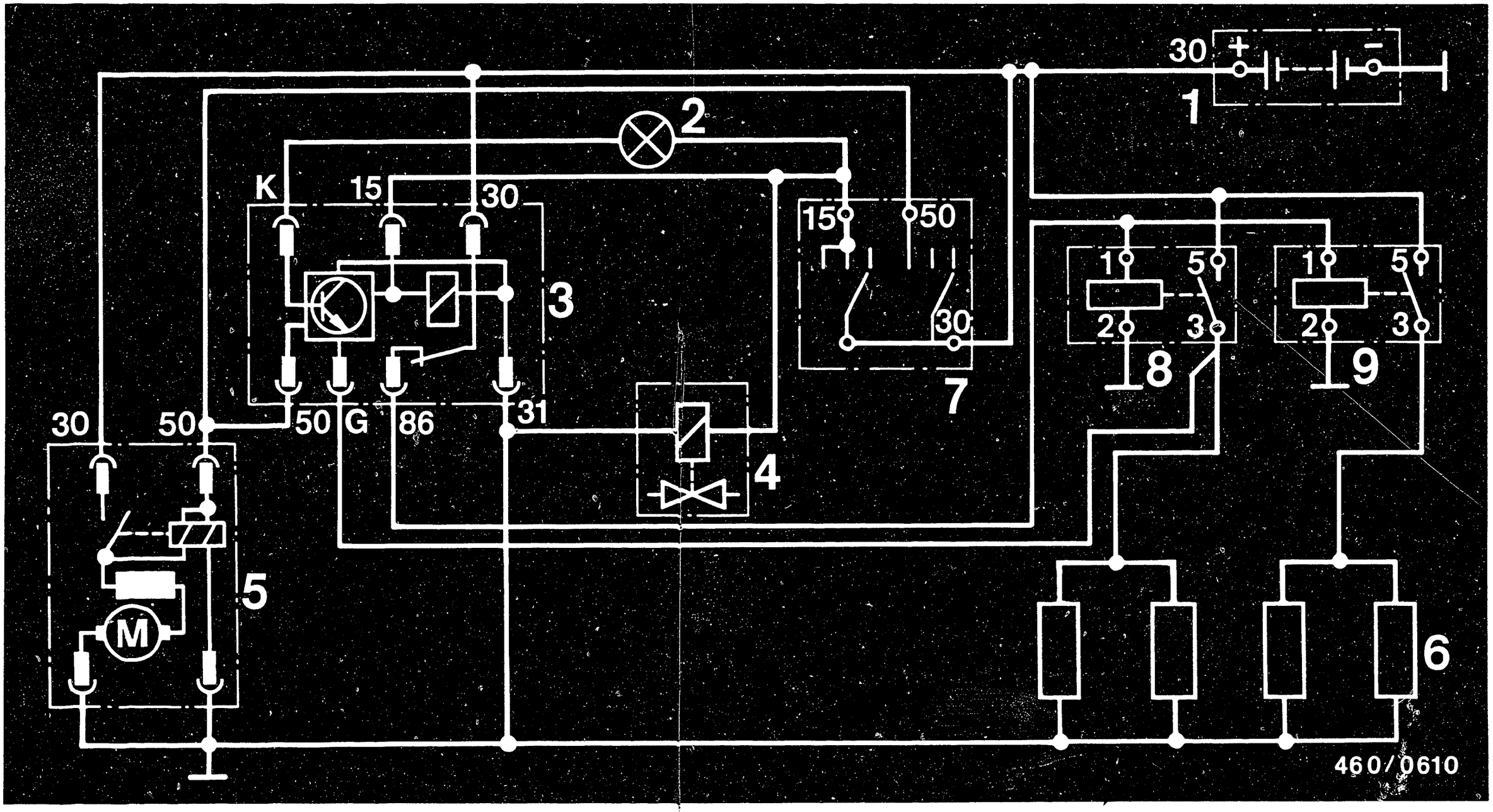
Engine speed	Ambient temperature	Operating time	Thermo-couple (Ri)
above 2000 min^{-1}	above + 35° C	not operating	23 Ω
	+ 20° C	30 s.	
	- 20° C	165 s.	

1.6 Toothed-belt tension

Scale interval	13 ... 14

1.7 Tightening torques

Injection-pump gear (hexagon nut)	50 Nm
Fuel lines	25 Nm
Fastening screws of injection pump	25 Nm
Cylinder-head cover	3 ... 6 Nm
Locking screw	10 Nm
Fastening screws for nozzle-holder assembly	65 ... 75 Nm
Sheathed-element glow plugs	15 ... 30 Nm
Angle bracket of injection pump (fastening screws)	25 Nm
Toothed-belt tensioning roller	40 Nm
Hollow screws, fuel lines	25 Nm
Pulley/Crankshaft	100 Nm



1 = Battery
2 = Glow-plug indicator lamp (12 V 2 W)
3 = Glow-duration unit 0 333 402 006
4 = Solenoid-operated valve
5 = Starting motor
6 = Sheathed-element glow plugs
7 = Glow-plug and starter switch
8 = Power relay
9 = Power relay

2. Terminal diagram of pre-heating system

3. Tools

Description	Part Number	Use
Puller	KDEP 1118	Removing injection-pump gear
Setting mandrel	KDEP 1123	Locking crankshaft
Holding device	KDEP 1147	For locking the pump drive gear
Measuring tool	KDEP 1085	Injection timing

4. Removing injection pump

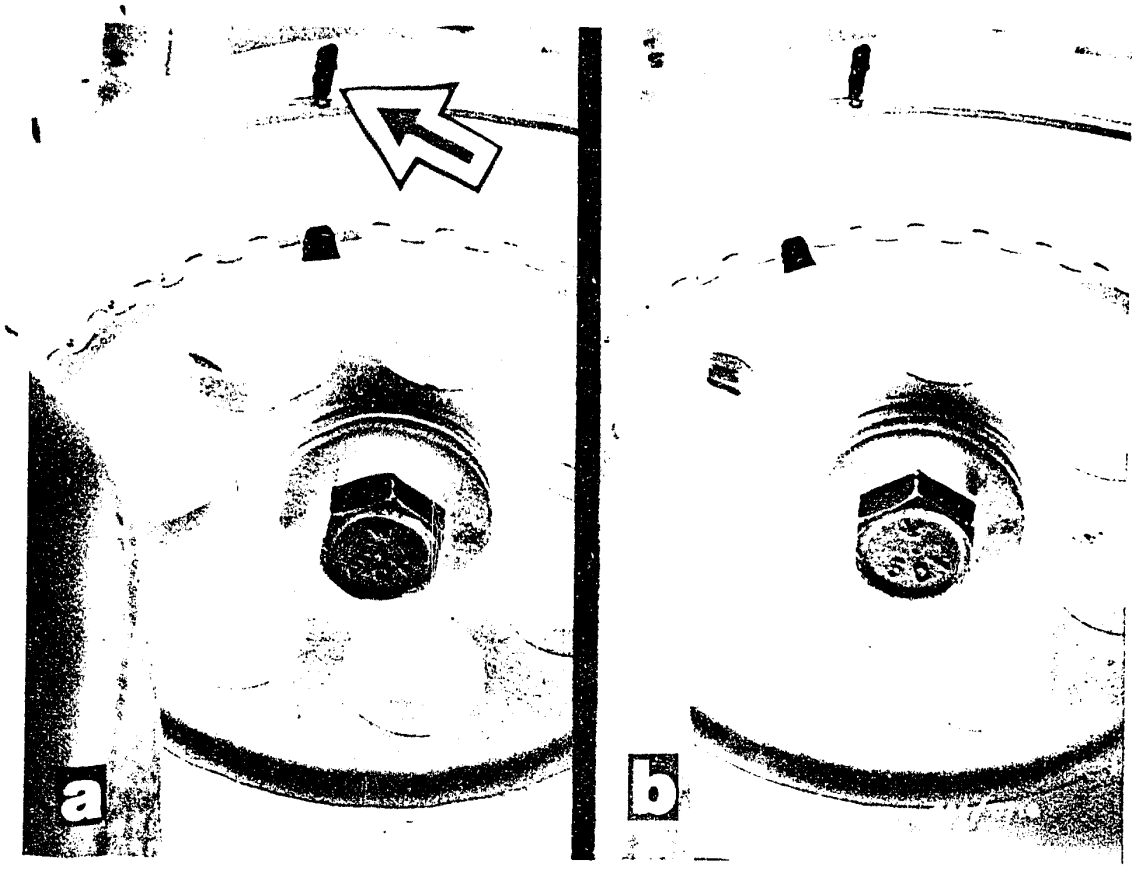
Disconnect negative cable from battery.

Remove toothed-belt protective cover.

Engage 4th gear and jack up right-hand front wheel.

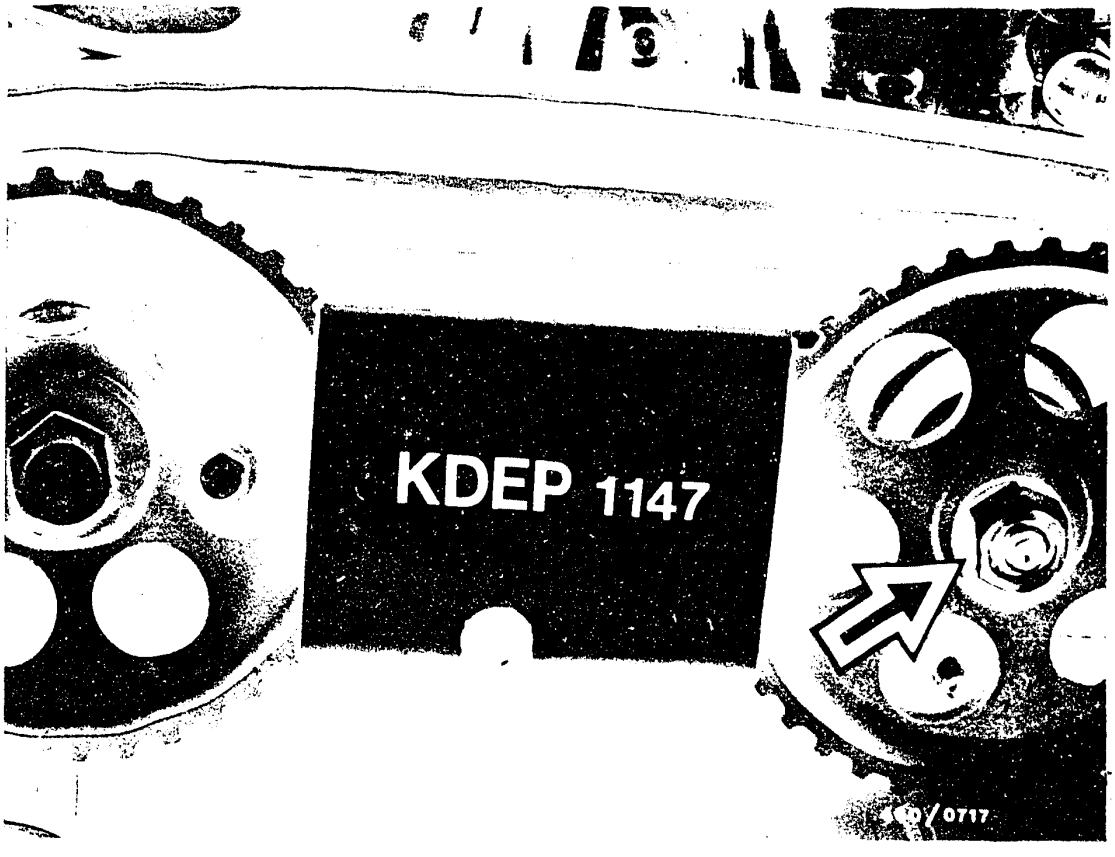
By turning the front wheel, position the piston in cylinder 1 (flywheel end) at TDC (left-hand illustration).

Check position of crankshaft using setting mandrel KDEP 1123 (right-hand picture).



In TDC position, mark the positions of the markings on the camshaft gear and the injection-pump gear on the timing-gear cover (illustration a, arrow).

Then turn the timing gears back one tooth (illustration b).

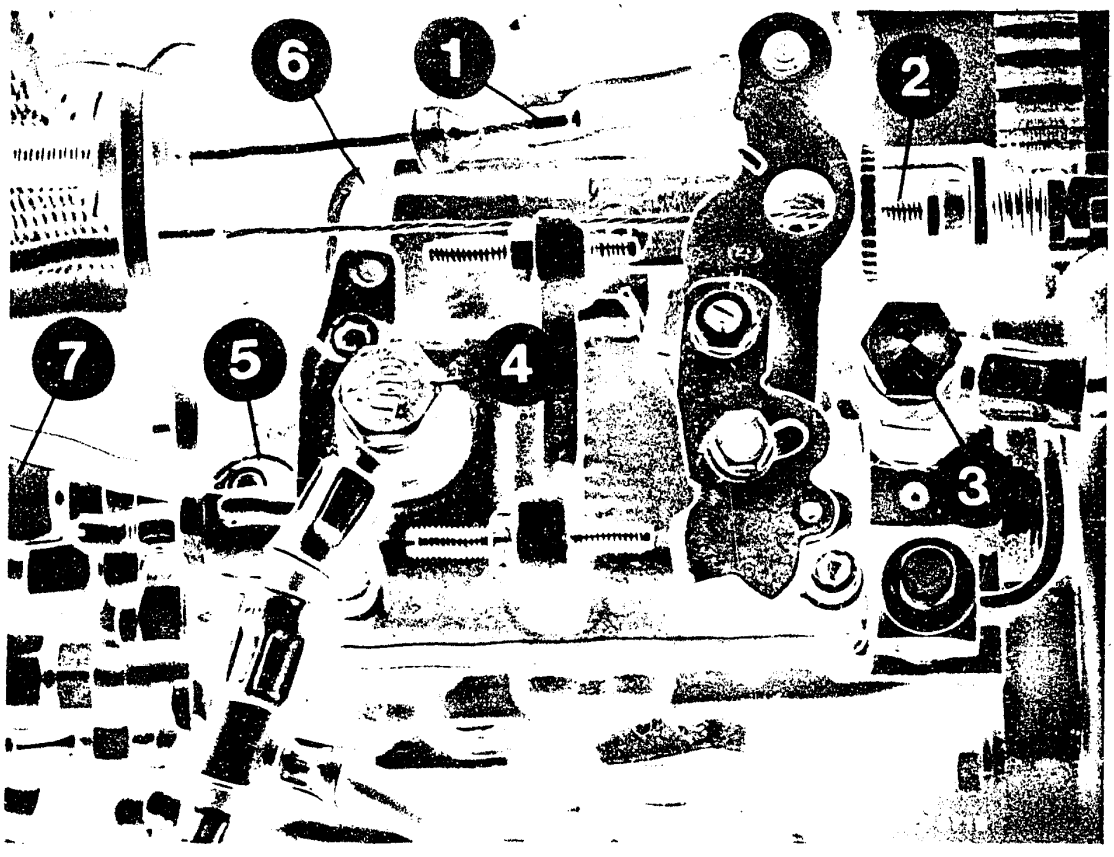


Insert holding device KDEP 1147 between camshaft gear and injection-pump gear (see illustration).

Loosen fastening screw of injection-pump gear (arrow) and screw out approx. 2 rotations.

Loosen injection-pump gear using puller KDEP 1118.

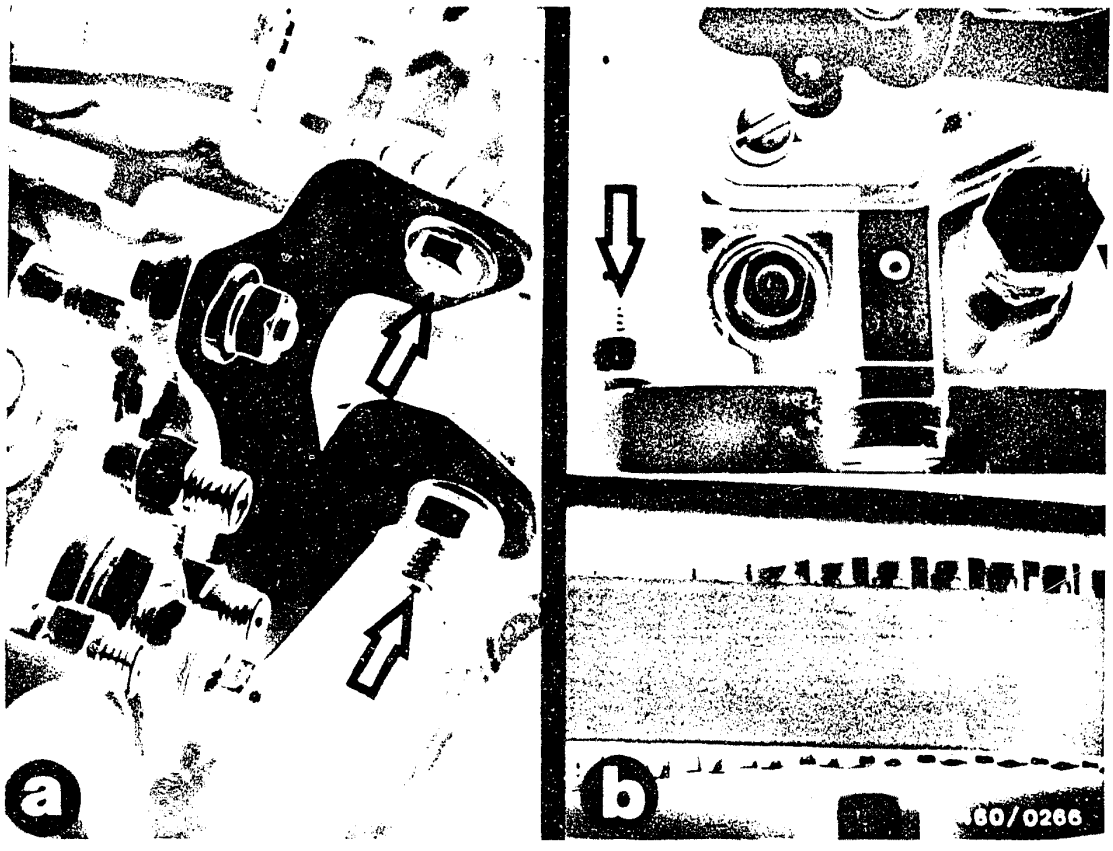
Remove fastening screw and washer from drive shaft of injection pump.



Remove bowden cable at control lever of injection pump (1), bowden cable for increased idle (2), fuel inlet line (3), fuel return line (4), connecting cable for electric shutoff device (3), connecting cable for cold-start device (6) and injection lines (7).

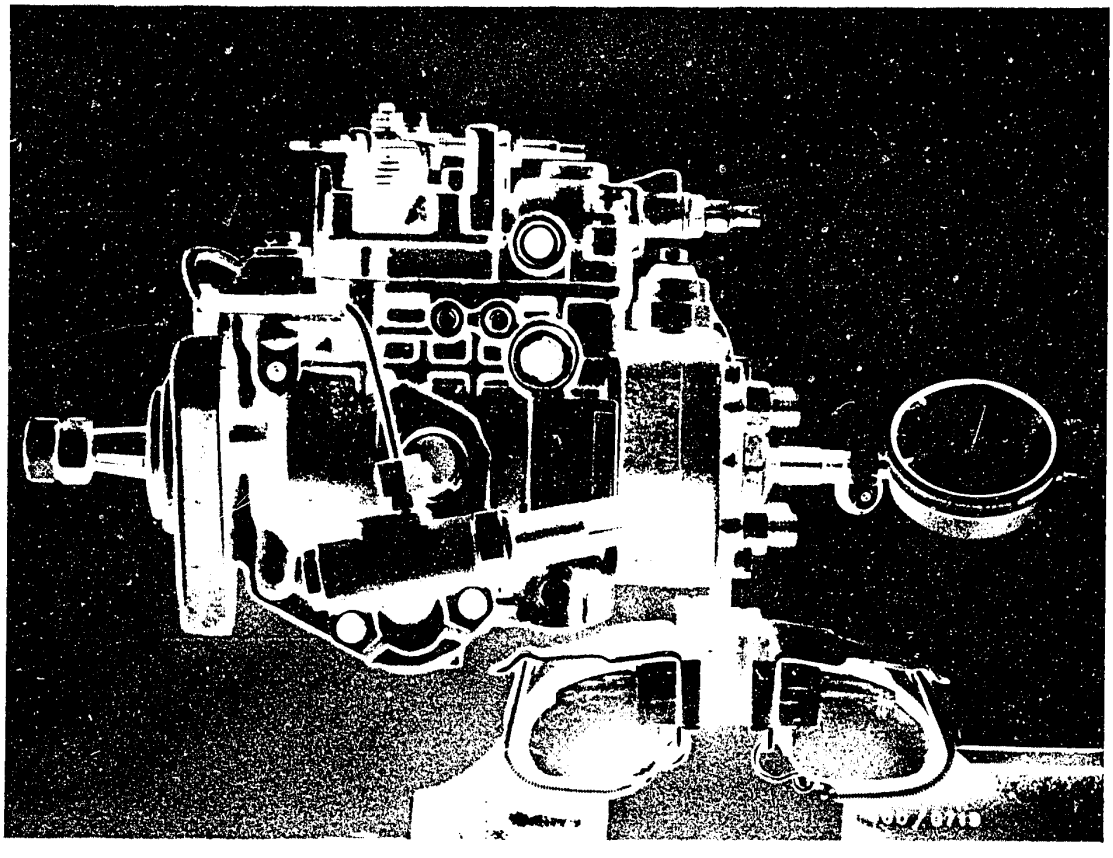
Note:

Prevent the delivery-valve holder from loosening by counterholding.



Unscrew injection pump support bracket fastening screws (arrows, Fig. a).

Remove injection-pump fastening nuts on pump flange and remove injection pump (arrow, Fig. b).



5. Install fuel-injection pump

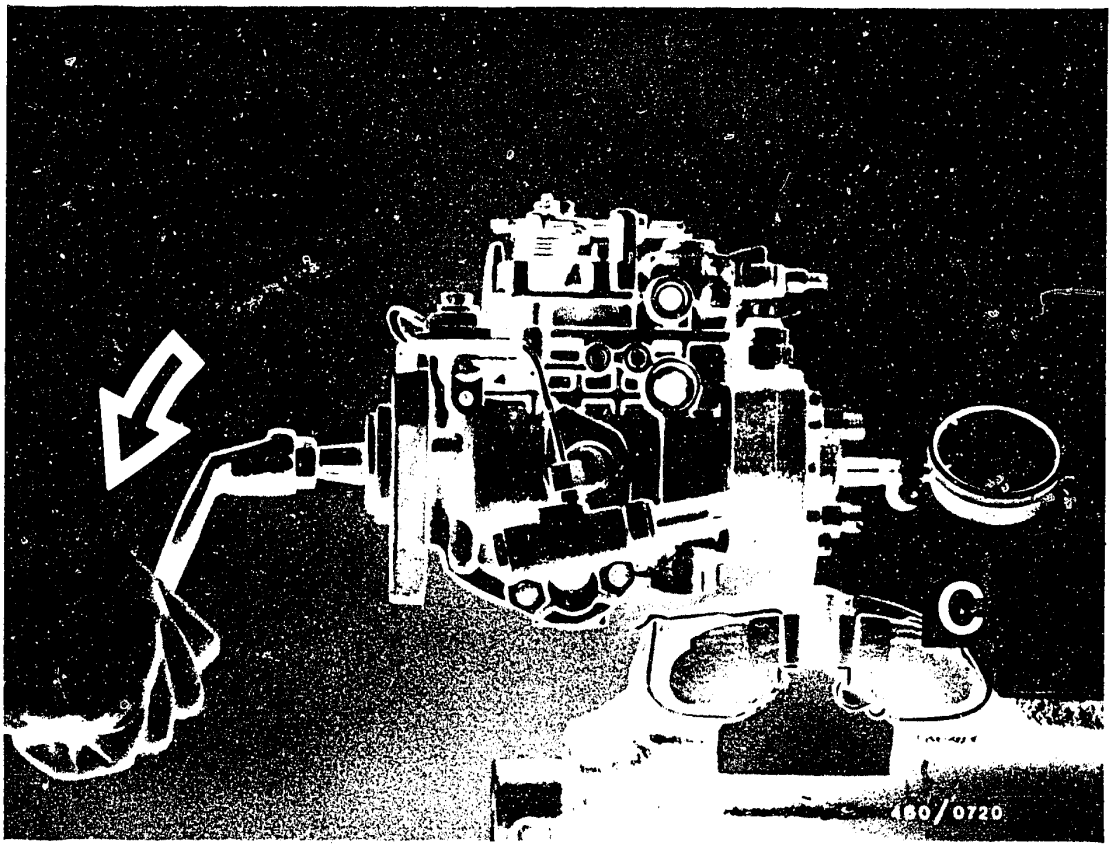
Clamp fuel-injection pump in a vice.

Screw two hexagon nuts onto the injection-pump drive shaft and lock.

Remove injection-pump bleeder screw.

Mount measuring tool KDEP 1085 in the tapped hole of the bleeder screw.

Mount dial indicator 1 687 233 011 with measuring base in measuring tool KDEP 1085 (see illustration).



Turn pump shaft in direction of arrow until the distributor-pump plunger reaches BDC.

In this position, preload dial indicator by 3 mm and set to "0".

Continue to turn drive shaft in direction of arrow until the V-groove (once again with distributor-pump plunger in BDC position) points to outlet "C" (see illustration) of hydraulic head.

Unscrew hexagon nuts (do not turn drive shaft any further).

Insert Woodruff key in groove in drive shaft.

Introduce injection pump into bore in pump drive gear.

Screw on fastening nuts of injection pump by hand.

Mount plain washer and fastening nut of pump drive gear and tighten to 50 Nm.

Remove holding device KDEP 1147.

Turn crankshaft twice in direction of engine rotation.

At TDC of cylinder 1, fix crankshaft using setting mandrel KDEP 1123.

In this position, dial indicator at injection pump must indicate a plunger lift of 0.65 mm after BDC.

If necessary, correct by pivoting the injection pump.

Note:

Poor tensioning of the toothed belt adversely affects the pump setting.

Check toothed-belt tension using belt-tension testing tool KDEP 1121.

Turn the vernier sleeve until the lower edge of the sleeve coincides with the locating mark on the measuring tongue.

Read off measured value.

Set value: Scale interval 13 ... 14

Testing the setting

Remove setting mandrel KDEP 1123.

Turn crankshaft 1 3/4 turns in direction of rotation.

Check whether dial indicator is at "0" with distributor-pump plunger in BDC position.

Turn crankshaft further as far as TDC position (engine) and lock with setting mandrel KDEP 1123.

The dial indicator on the injection pump must indicate a piston stroke of 0.63 ... 0.67 mm.

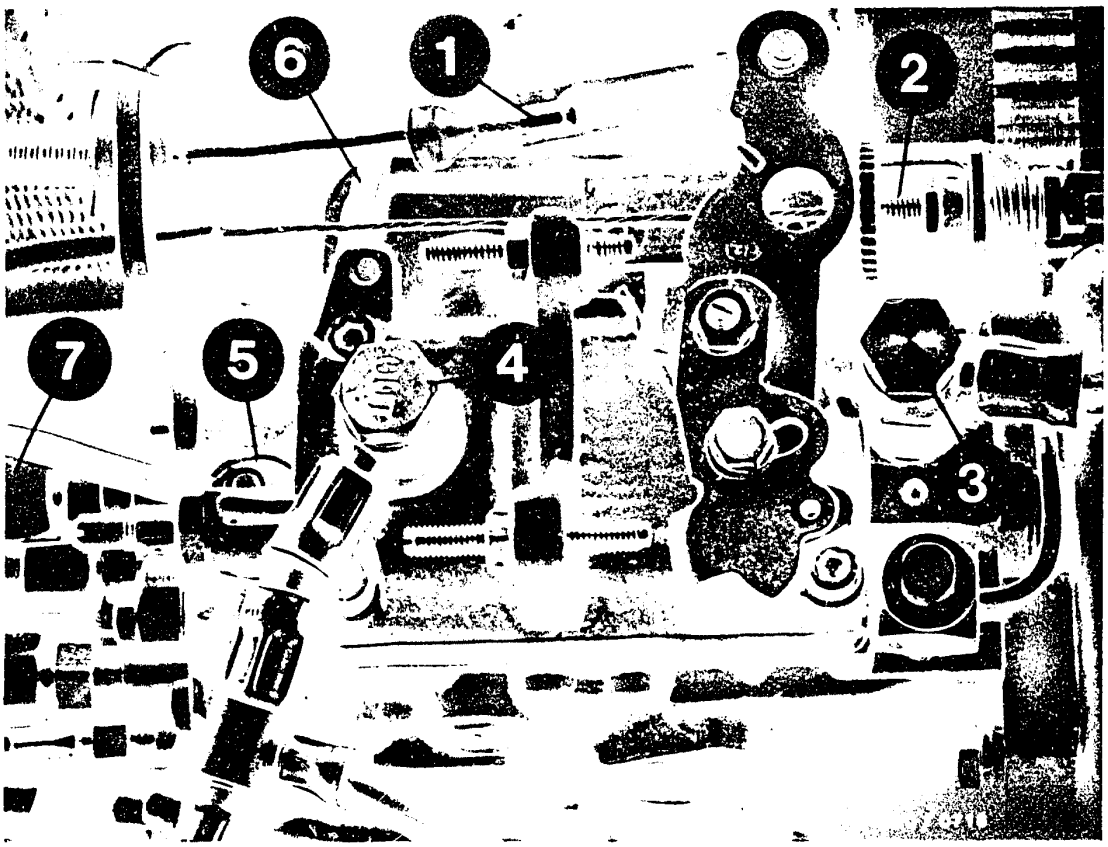
Remove setting mandrel KDEP 1123.

Tighten injection-pump fastening nuts to 25 Nm.

Remove measuring tool KDEP 1085 with dial indicator and fit bleeder screw with new copper seal ring.

Mount support bracket on injection-pump hydraulic head and tighten fastening screws.

Mount toothed-belt protective cover.



Assemble bowden cable at control lever of injection pump (1), bowden cable for increased idle (2), fuel inlet line (3), fuel return line (4), connecting cable for electric shutoff device (5), connecting cable for cold-start device (6) and injection lines (7). (Prevent the delivery-valve holder from turning by counterholding.)

Connect negative cable to battery.

Note:
The hollow screws of the fuel-inlet and fuel-return lines must not be mixed up.
The hollow screw of the return is equipped with restriction bores and is identified at the screw head by the marking "Out".

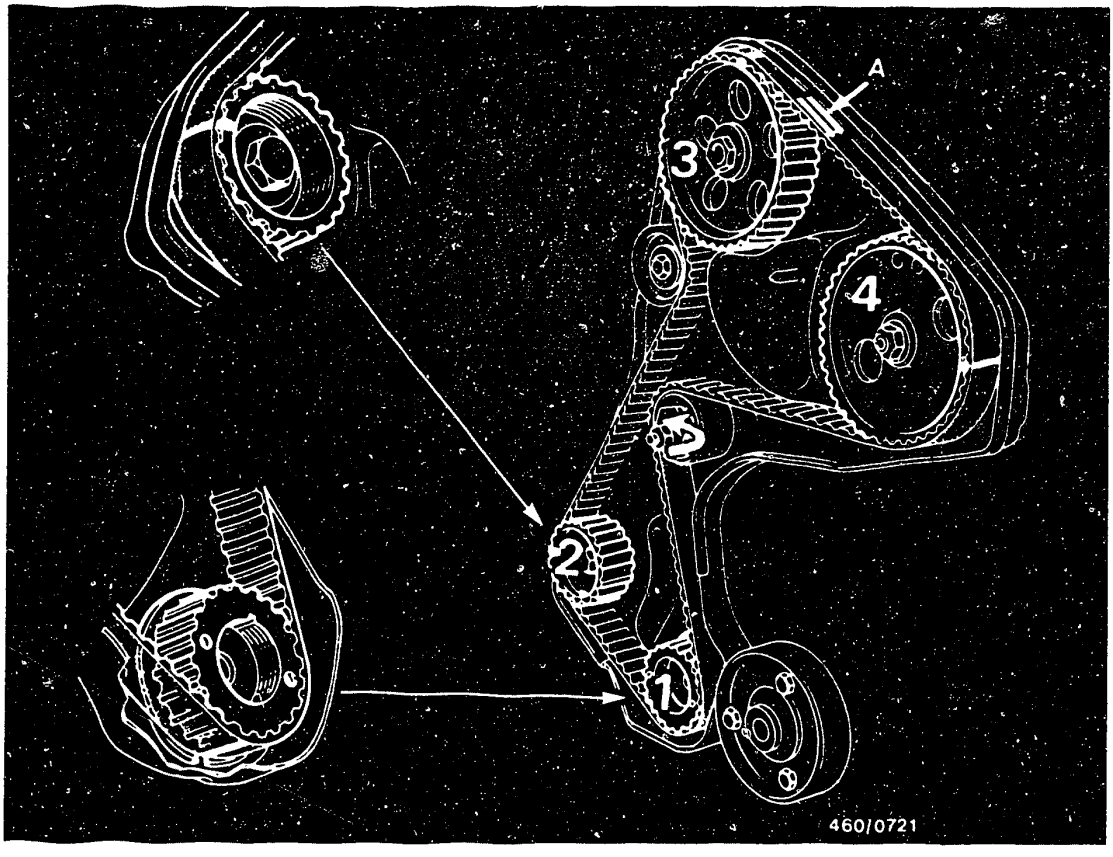
6. Testing and adjusting engine timing

6.1 Testing engine timing

Remove cylinder-head cover and toothed-belt protective cover.

Turn crankshaft to TDC of cylinder 1 (cylinder 4 at valve overlap) and fix using setting mandrel KDEP 1123.

Remove V-belt from generator and pulley of crankshaft.



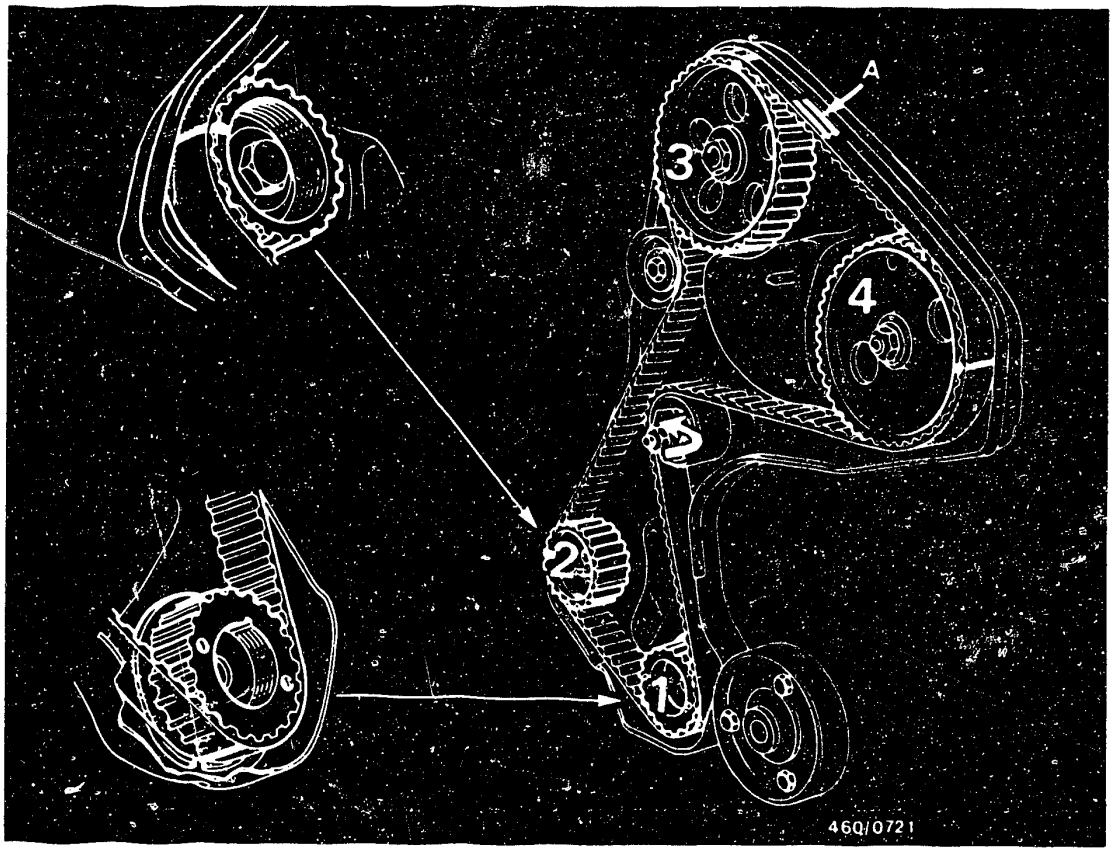
Check number of teeth on toothed belt between the markings on the toothed gears:

18 teeth between toothed gears 1 and 2

47 teeth between toothed gears 2 and 3

29 teeth between toothed gears 3 and 4

If these numbers of teeth are not obtained, the engine timing must be adjusted accordingly.



6.2 Adjusting engine timing

Loosen toothed-belt tensioning roller and remove toothed belt.

Check whether setting mandrel KDEP 1123 is locking crankshaft at TDC of cylinder 1.

Align locating marks on toothed belt with those on the timing gears.

Position toothed belt over toothed wheels in sequence 1 - 2 - 3 and 4.

Arrow markings on toothed belt (arrow A) indicate the direction of assembly and must be positioned between camshaft gear and injection-pump gear.

Remove setting mandrel KDEP 1123.

By turning the tensioning roller counterclockwise, adjust toothed belt to scale interval 13 ... 14 in accordance with belt-tension testing tool KDEP 1121.

Tighten fastening nut of tensioning roller to 40 Nm.

Turn crankshaft of engine twice.

Fix crankshaft at TDC of cylinder 1 using setting mandrel.

Check toothed-belt tension and number of teeth on toothed belt between the markings of the toothed gears once again.

18 teeth between toothed gears 1 and 2

47 teeth between toothed gears 2 and 3

29 teeth between toothed gears 3 and 4

Remove setting mandrel.

Tighten pulley of crankshaft to 100 Nm.

Position V-belt of generator and tension.

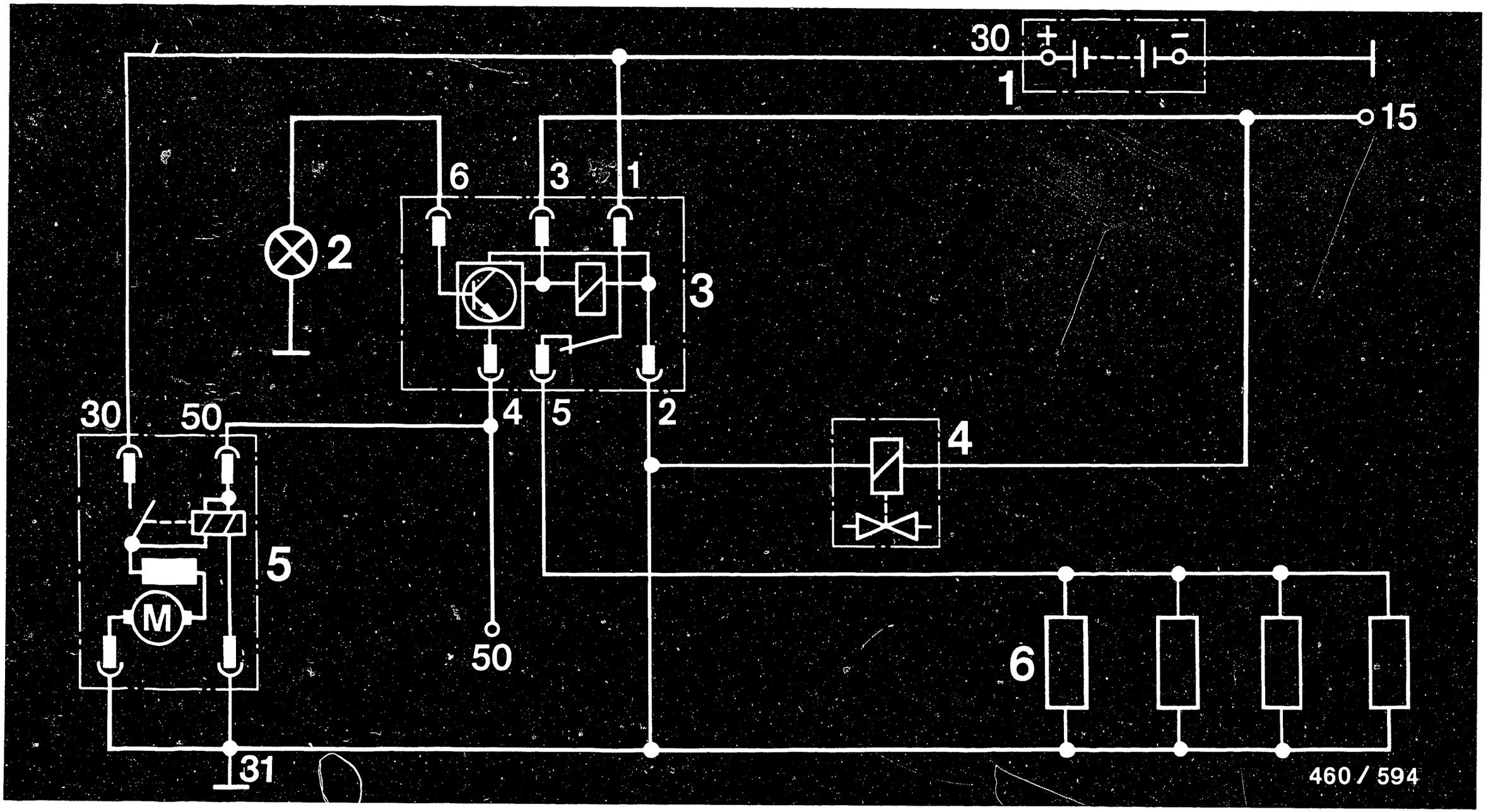
Assemble cylinder-head cover and toothed-belt protective cover.

TABLE OF CONTENTS

1. Test specifications

1.1 Idle speed:	700 + 50 min^{-1}
1.2 Nozzle-opening pressure:	157 + 8 bar
1.3 Injection timing:	
Engine position:	Cylinder 1 at TDC
Setting value	
Pump position:	0.90 mm ABDC
1.4 Charge-air pressure:	0.87 bar
1.5 Compression pressure:	approx. 22 bar
1.6 Tightening torques	
Injection-pump gear (Hexagon nut)	98 Nm
Sheathed-element glow plugs	15 Nm
Nozzle-holder assembly fastening screws	49 Nm
Fastening nuts for intake/ exhaust manifold	25 Nm
Fuel lines	25 Nm
Screw plug	10 Nm
Injection-pump fastening screws	25 Nm

Note:
The installed diesel engine is basically the same as that in the Fiat Argenta 2500 Turbo-Diesel.
Similar SIS instructions: Microcard FIA 502.



1 = Battery
2 = Glow-plug indicator lamp
3 = Glow-duration unit
4 = Solenoid-operated valve
5 = Starting motor
6 = Sheathed-element glow plugs

2. Connection diagram for preheating system

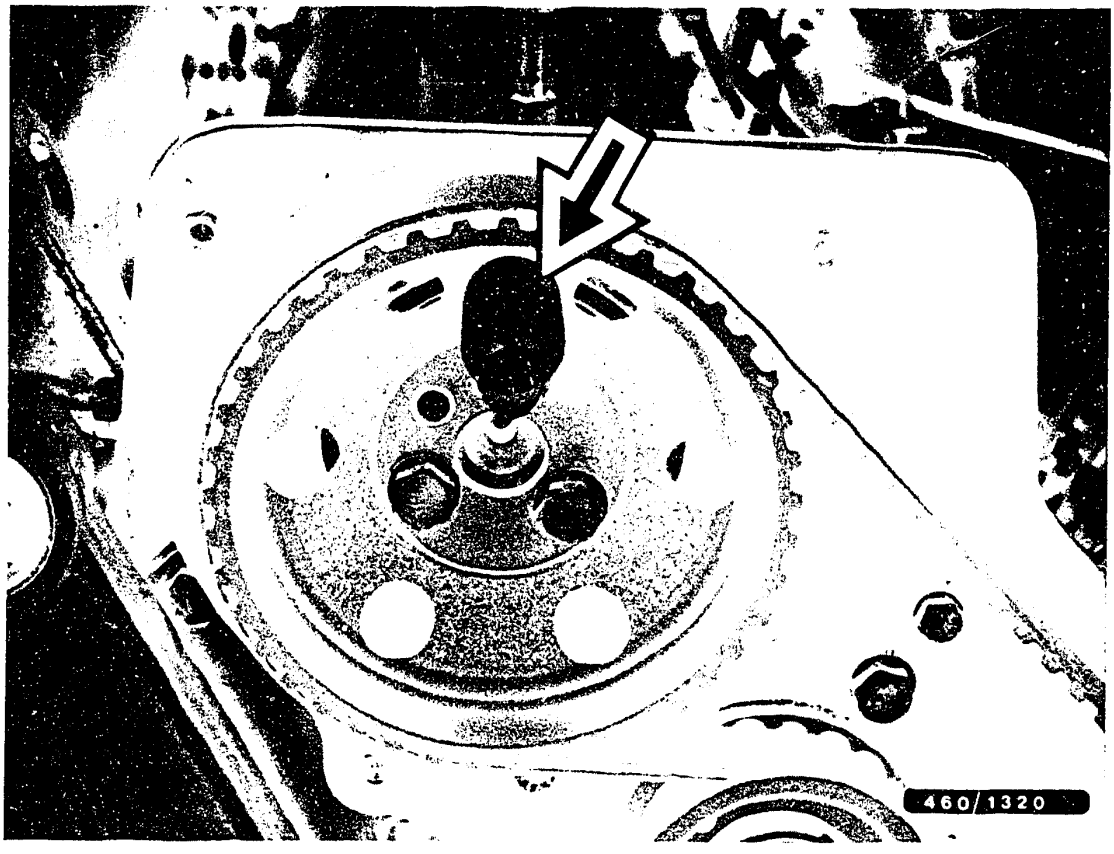
3. Test equipment and tools

Designation	Part No.	Use
Box wrench	KDEP 1115	Loosening/ tightening fuel-injection lines
Measuring tool	KDEP 1085	Injection timing
Mini-dial indicator graduation 1/100 mm	1 687 233 011	Injection timing
Pressure tester or pressure gauge 0...1.6 bar	KDJE-P 100 e.g., Wika No. 4 184	Testing charge-air pressure
Locating pin	commercially available	Locking injection-pump gear/camshaft gear

4. Remove fuel injection pump

Disconnect negative lead from the battery.

Turn the crankshaft in the direction of engine rotation, until the TDC-mark on the clutch housing aligns with the reference "PMS-1" on the flywheel.

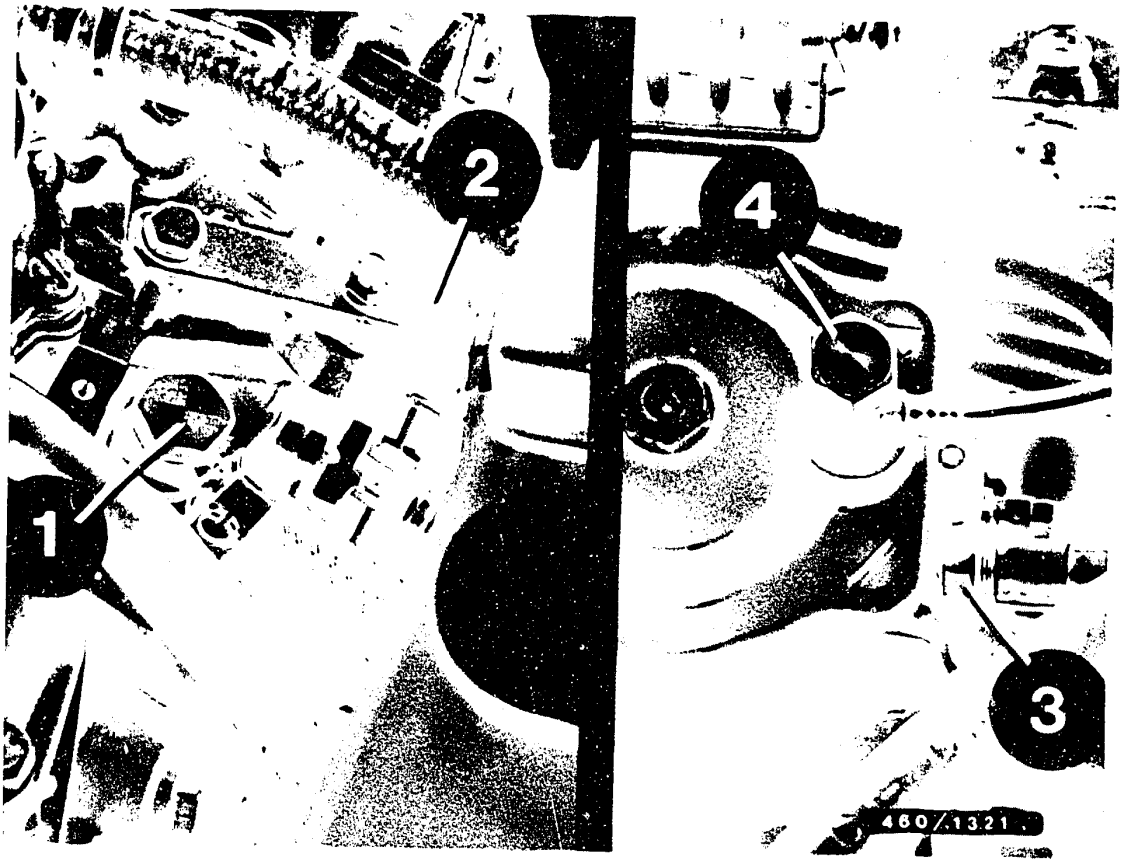


Remove toothed-belt protection-cover fastening screws and take off protection cover.

Lock camshaft gear with locking pin (5 mm) (arrow).

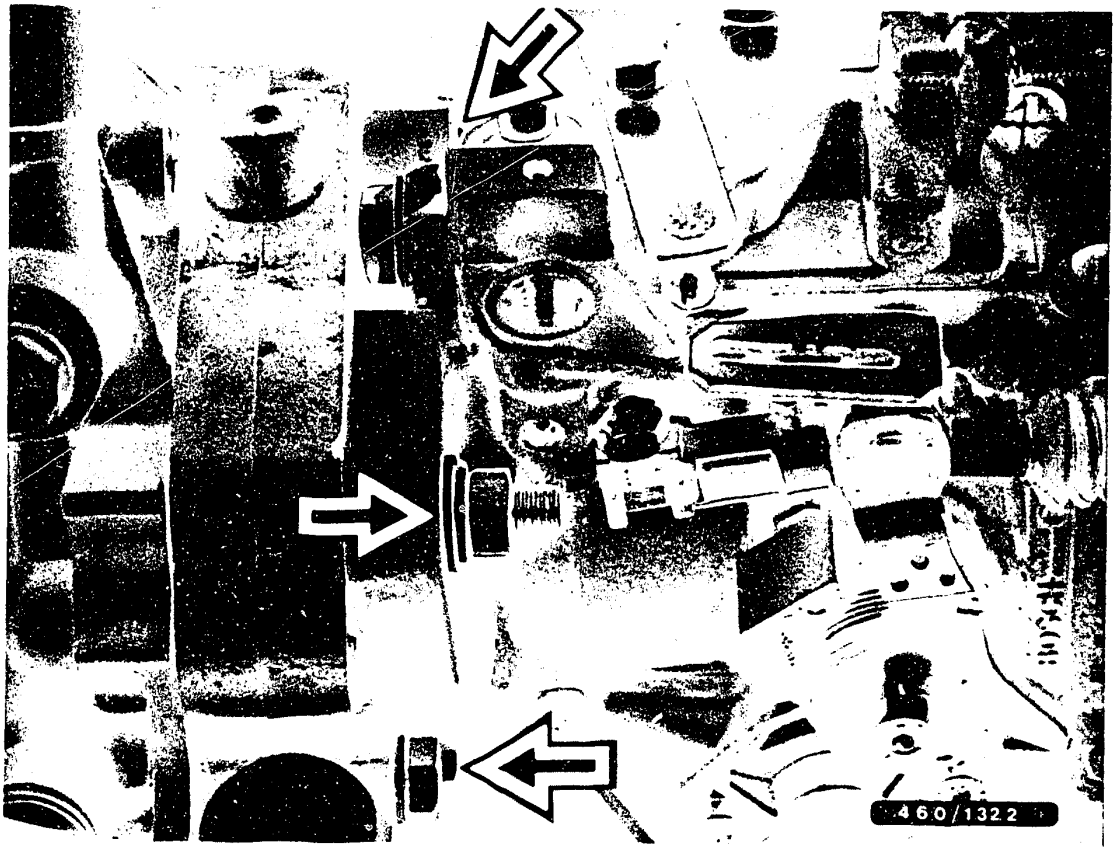
Note:

A punch or a twist drill of 5 mm diameter may be used as locking pin.



Remove the fuel inlet line (1), the cable on the control lever (2), the fuel return line (3), and the pressure line (4) to the manifold-pressure compensator casing.

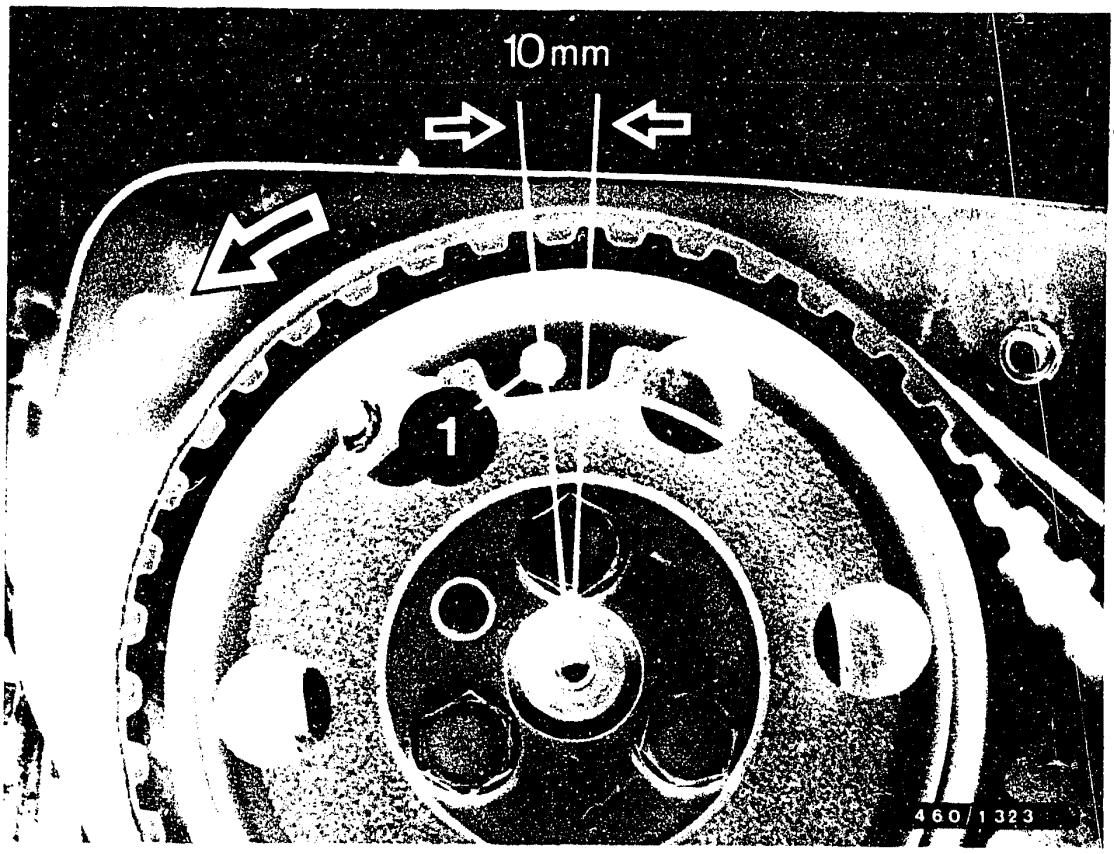
Disconnect the lead for the electrical shutoff device (not visible in the picture).



Using box wrench KDEP 1115, loosen the fuel-injection lines. (Prevent the delivery-valve holders from becoming loose by holding them with a wrench.)

Remove fastening nuts (arrows) on the fuel-injection pump.

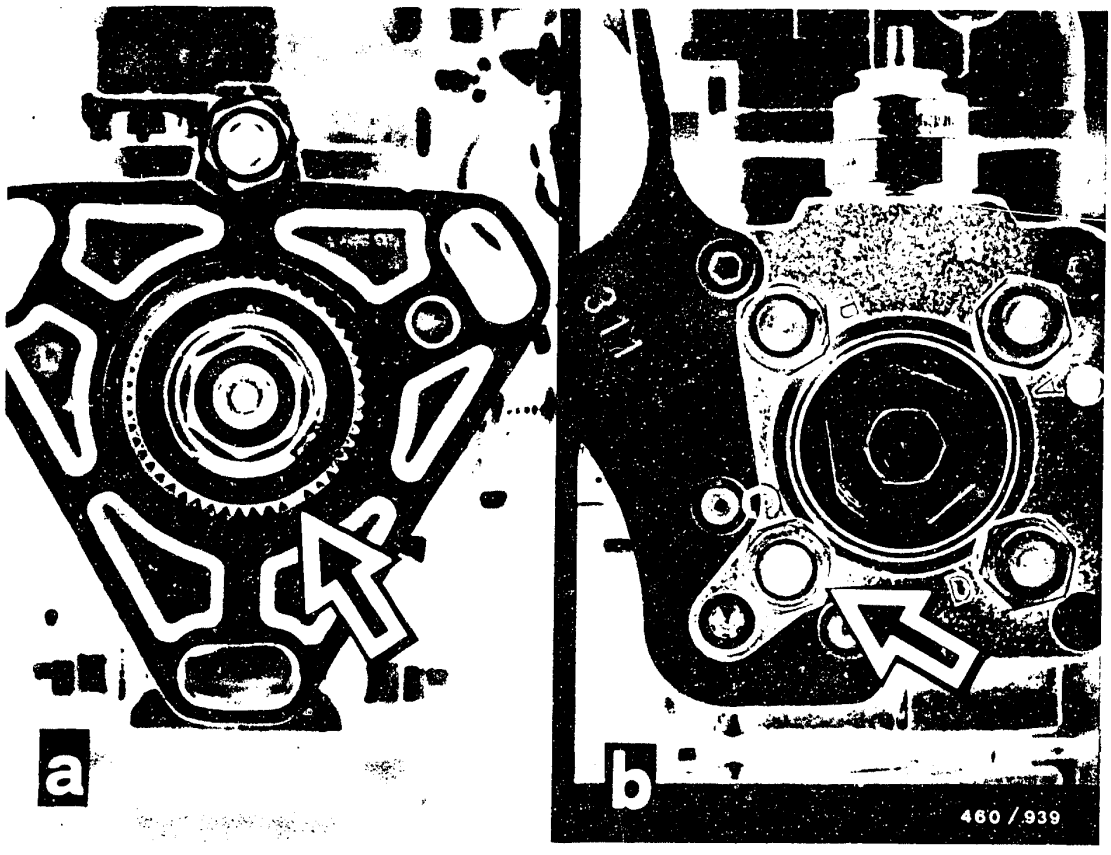
Remove fuel-injection pump from motor.



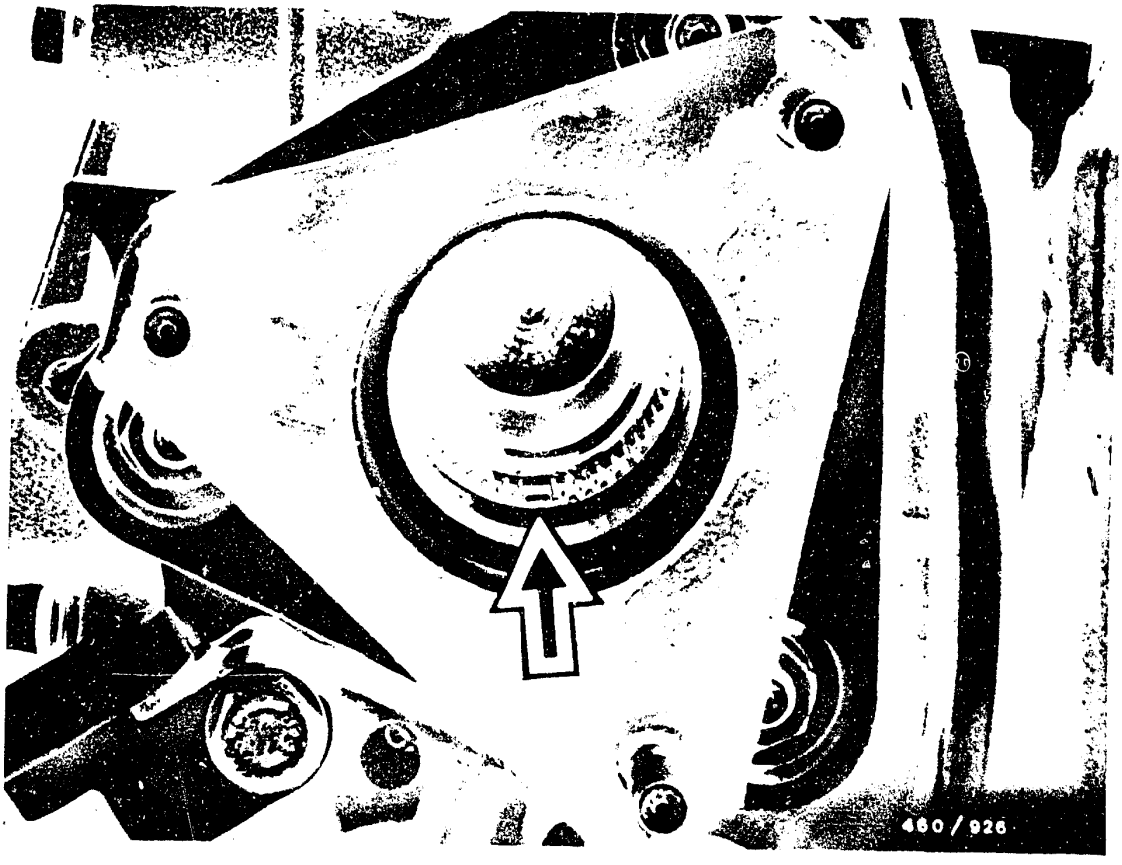
5. Install fuel-injection pump

Turn crankshaft against engine direction of rotation (direction of arrow) until locking bore on camshaft gear (1) is approx. 10 mm before locating bore (timing case).

Note:
Turning back the crankshaft makes it easier to insert the injection pump into the drive toothed sleeve.



Before inserting the fuel-injection pump into the timing case, align the mark on the drive gear (illustration a-arrow) with outlet "C" (illustration b-arrow).

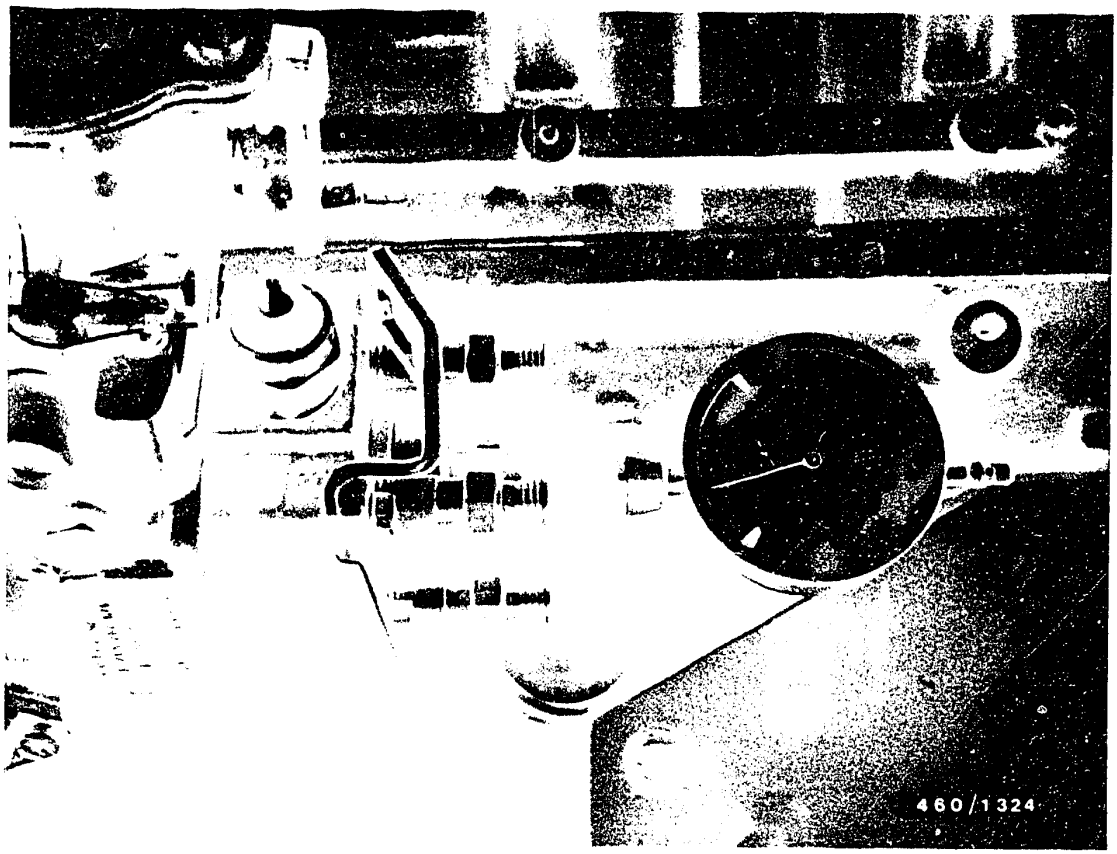


Place fuel-injection pump on the engine, introducing the mark on the fuel-injection pump gear at the missing tooth on the drive shaft (arrow).

Pivot the fuel-injection pump into the middle position in the slots.

Screw on the fastening nuts and finger-tighten them.

Turn the crankshaft in the direction of engine rotation, until the TDC-mark on the clutch housing aligns with the reference mark "PMS-1" on the flywheel.



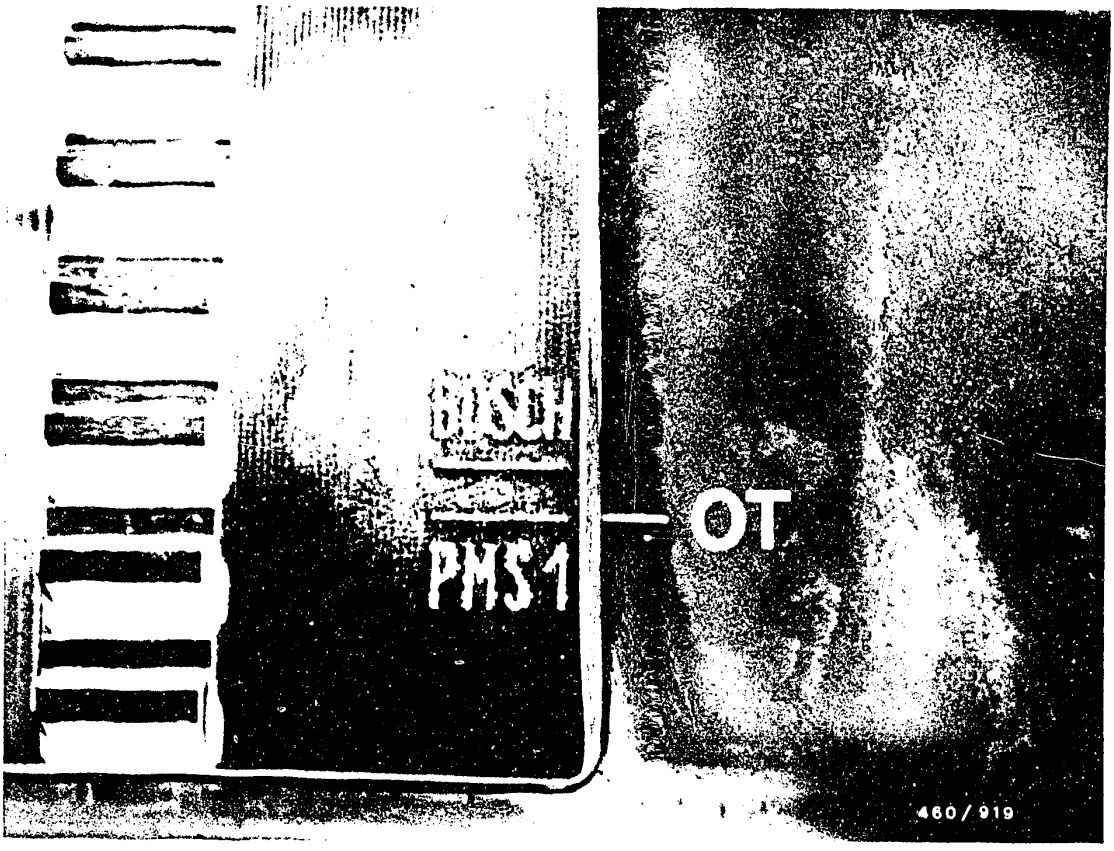
Unscrew the bleeder screw from the central screw plug (triangular-head plug) on the hydraulic head.

Mount measuring tool KDEP 1085 and the dial indicator in the threaded hole.

Preload the dial indicator by approx. 3 mm .

Slowly turn the crankshaft counter to the direction of engine rotation, until the needle on the dial indicator no longer moves.

Set the dial indicator at "0".



Turn crankshaft in direction of rotation until TDC mark on clutch housing aligns with reference mark "PMS-1" on flywheel (see picture).

In this position, the dial indicator must indicate a pump plunger stroke of 0.90 mm after BDC.

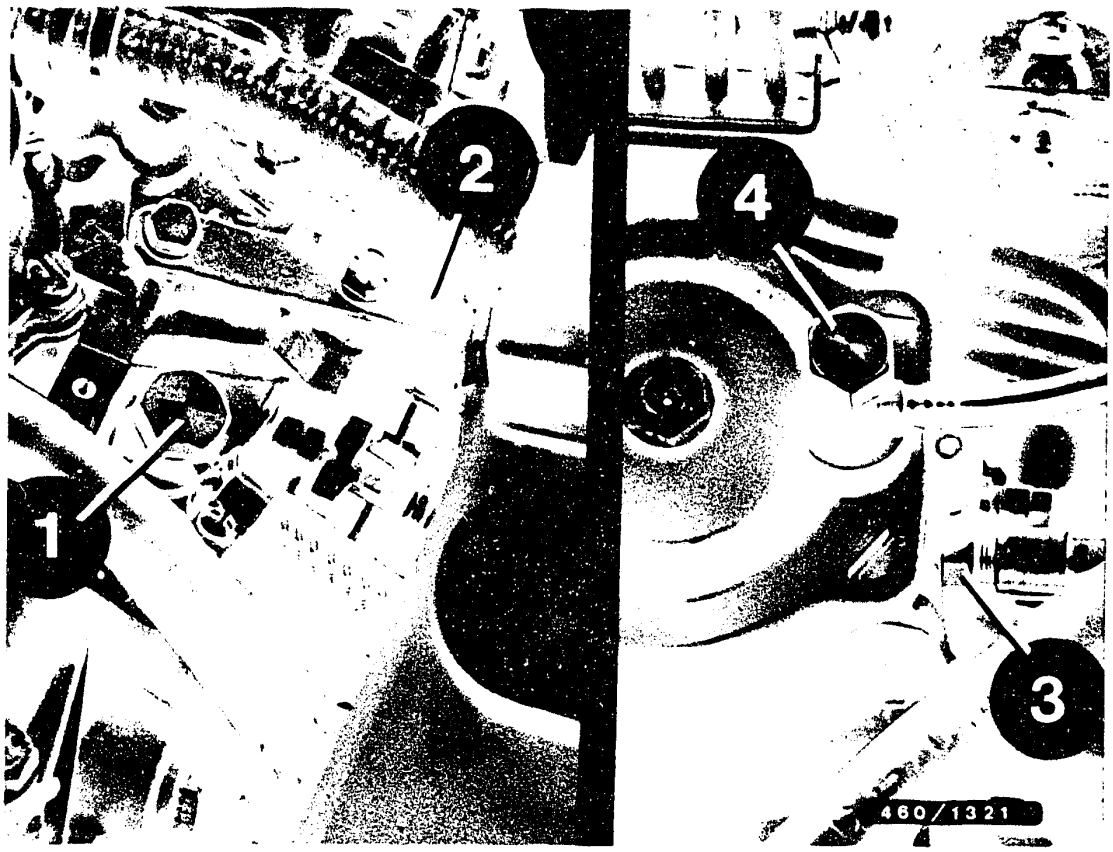
If a correction is necessary, loosen injection-pump fastening screws and pivot pump.

Tighten fastening screws to 25 Nm.

Turn crankshaft over twice and check adjustment again.

Remove measuring tool KDEP 1085 with dial indicator.

Mount bleeder screw with new seal ring.



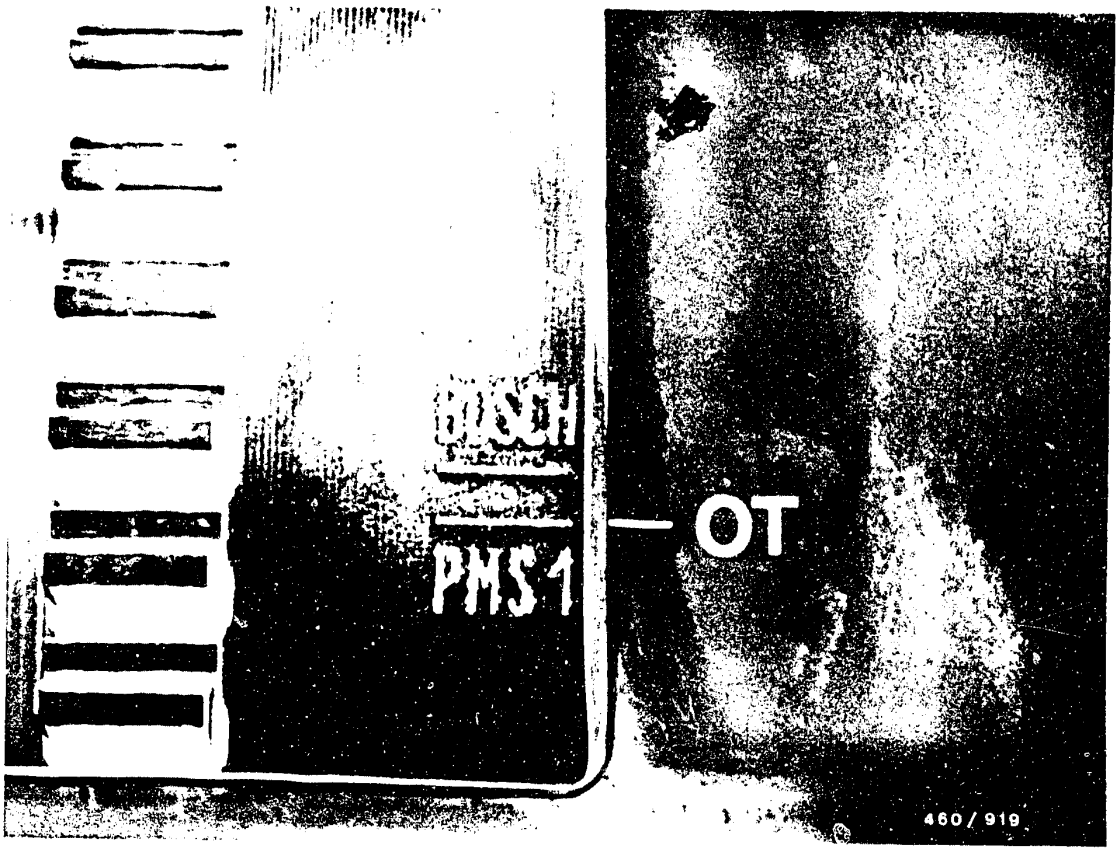
Mount fuel inlet line (1), cable on control lever (2), fuel return line (3) and delivery line (4) on manifold-pressure compensator housing.

Connect lead for electrical shutoff device.

Mount injection lines.
(Prevent delivery-valve holders from turning by holding with a wrench).

Connect negative cable to battery and mount toothed-belt protection cover.

Bleed fuel system.



6. Test and adjust engine timing

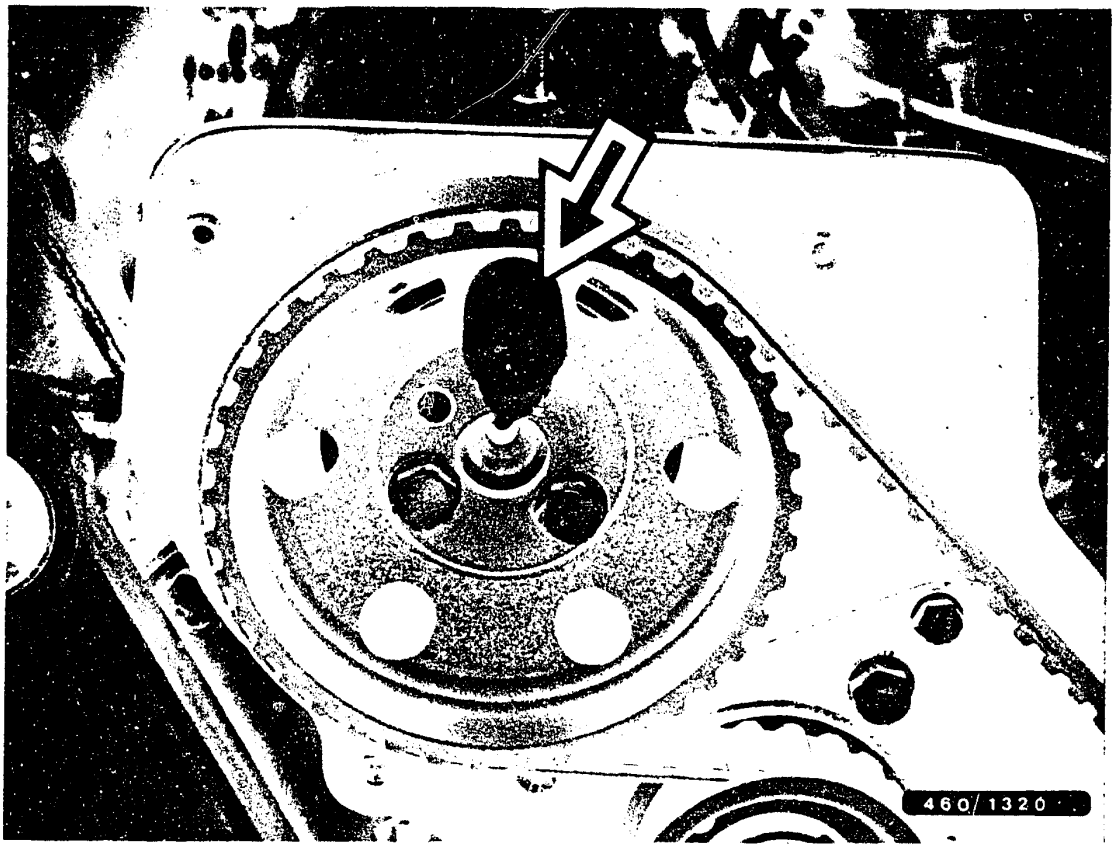
6.1 Test engine timing

Turn the crankshaft in the direction of engine rotation until the TDC mark on the clutch housing aligns with the reference mark "PMS-1" on the flywheel.

Remove toothed-belt protection-cover fastening screws and take off protection cover.

Remove cylinder-head cover.

Cylinder 1 on compression stroke (valves of cylinder 4 on overlap).

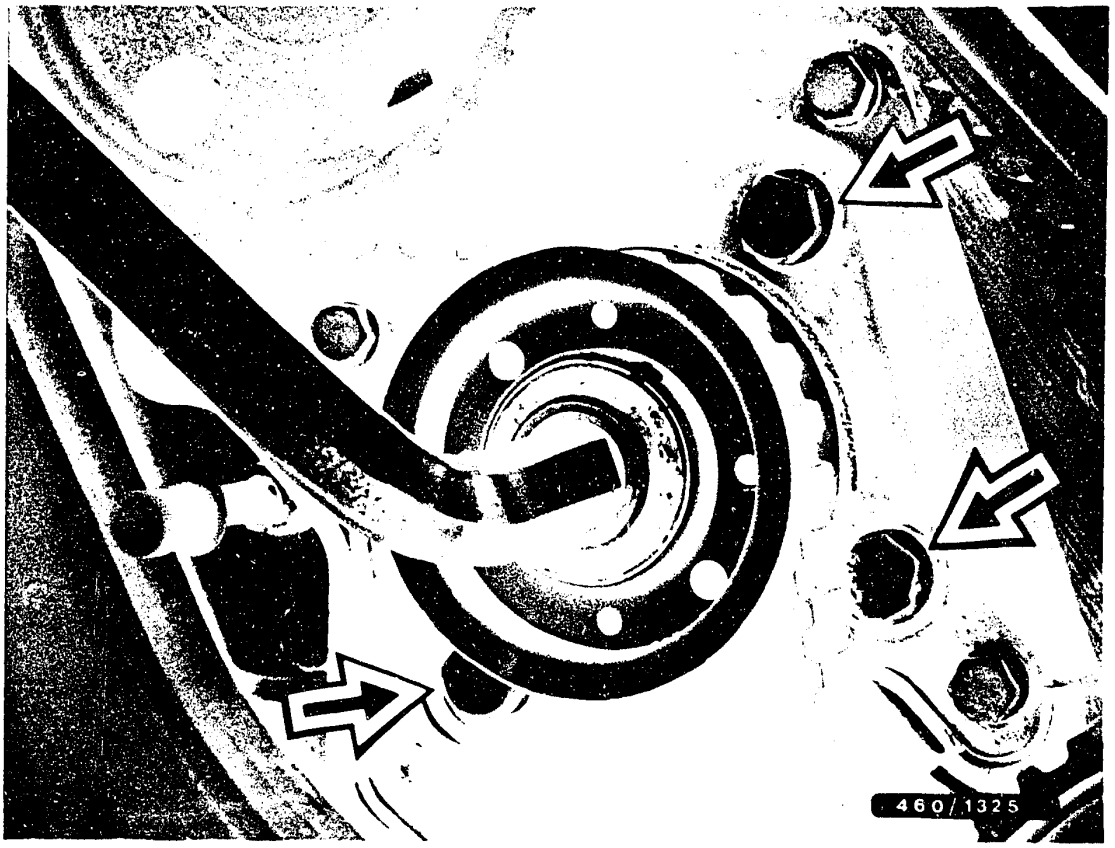


Lock camshaft gear and injection-pump drive gear with locking pins (5 mm) (see arrow).

If the locking pins cannot be introduced, correct the engine timing.

Note:

It is also possible to use punches or twist drills of 5 mm diameter as locking pins.

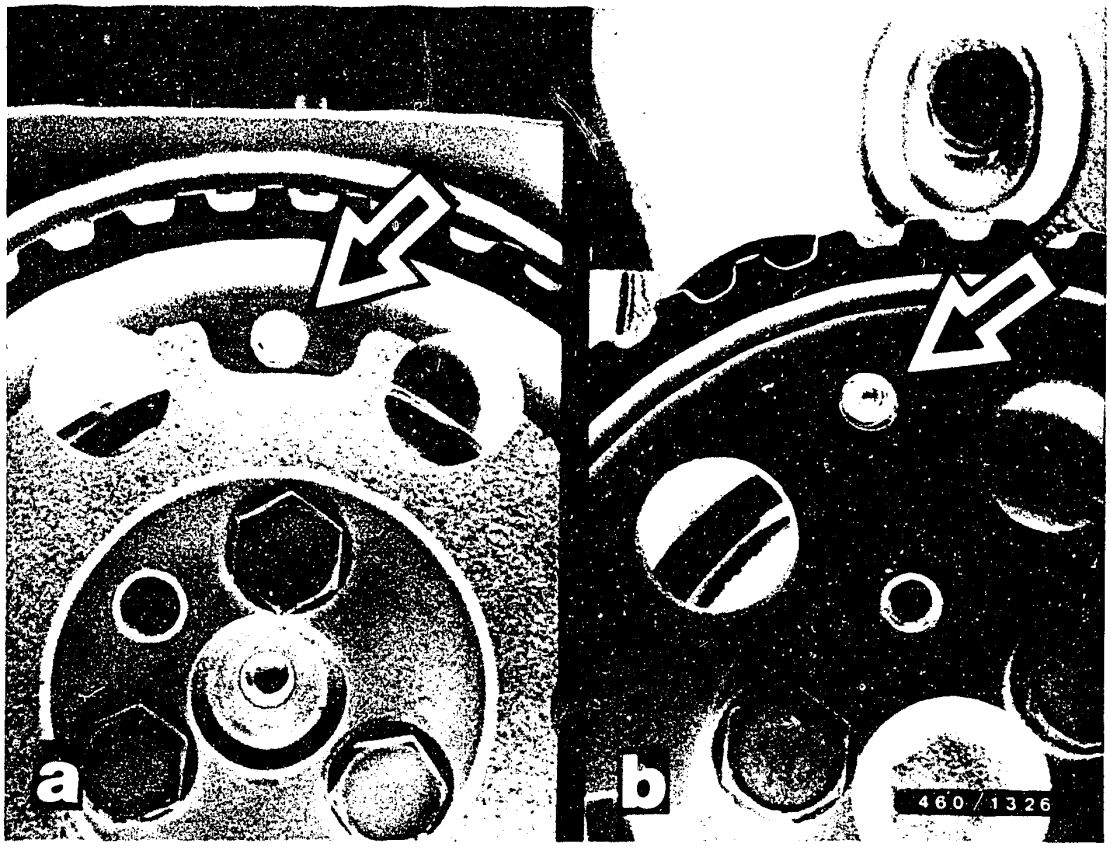


6.2 Adjust engine timing

Adjust toothed-belt tensioner locking screws (arrows).

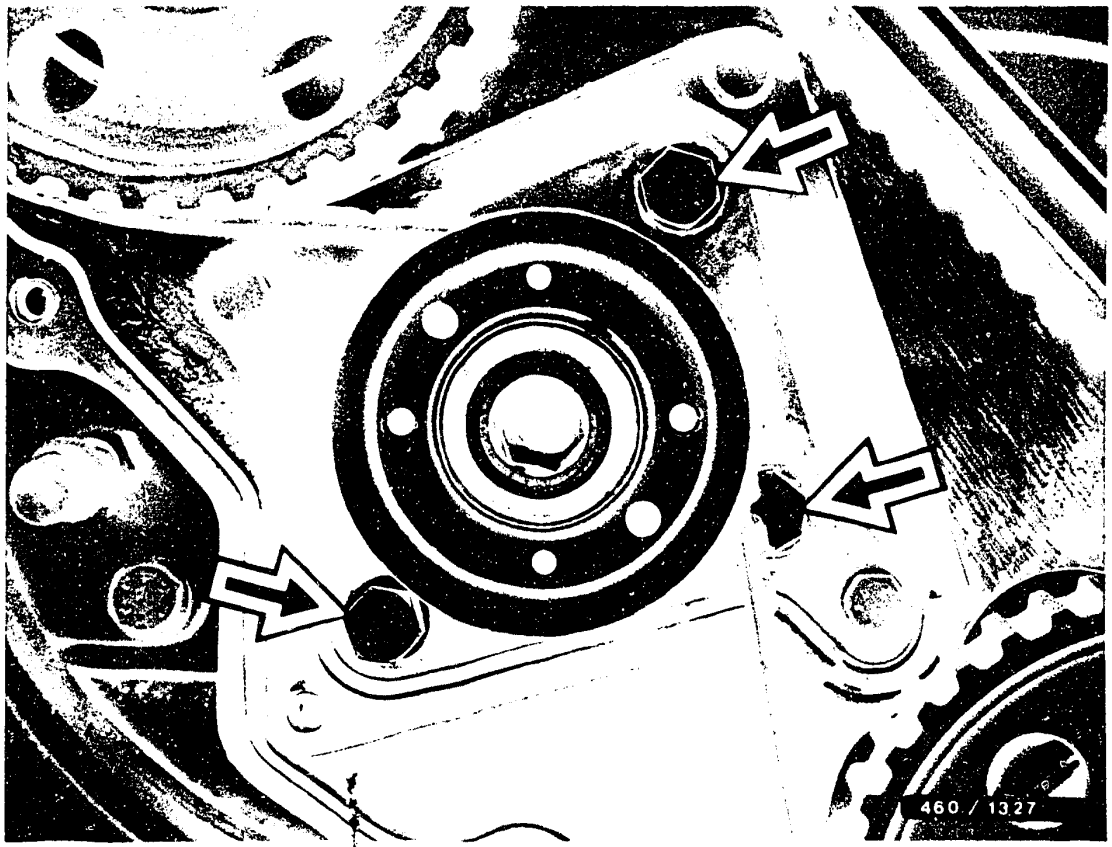
Using 14 mm hexagon-socket-screw key (see picture), force tensioning roller as far as it will go against the spring force and re-tighten one of the fastening screws.

Remove toothed belt from camshaft gear and injection-pump gear.



Turn camshaft gear (picture a) and injection-pump gear (picture b) to locking bores (arrows) and locate with locking pins.

Mount toothed belt.



Loosen provisionally tightened fastening screw on toothed-belt tensioner.
Toothed belt is automatically tensioned by built-in spring.

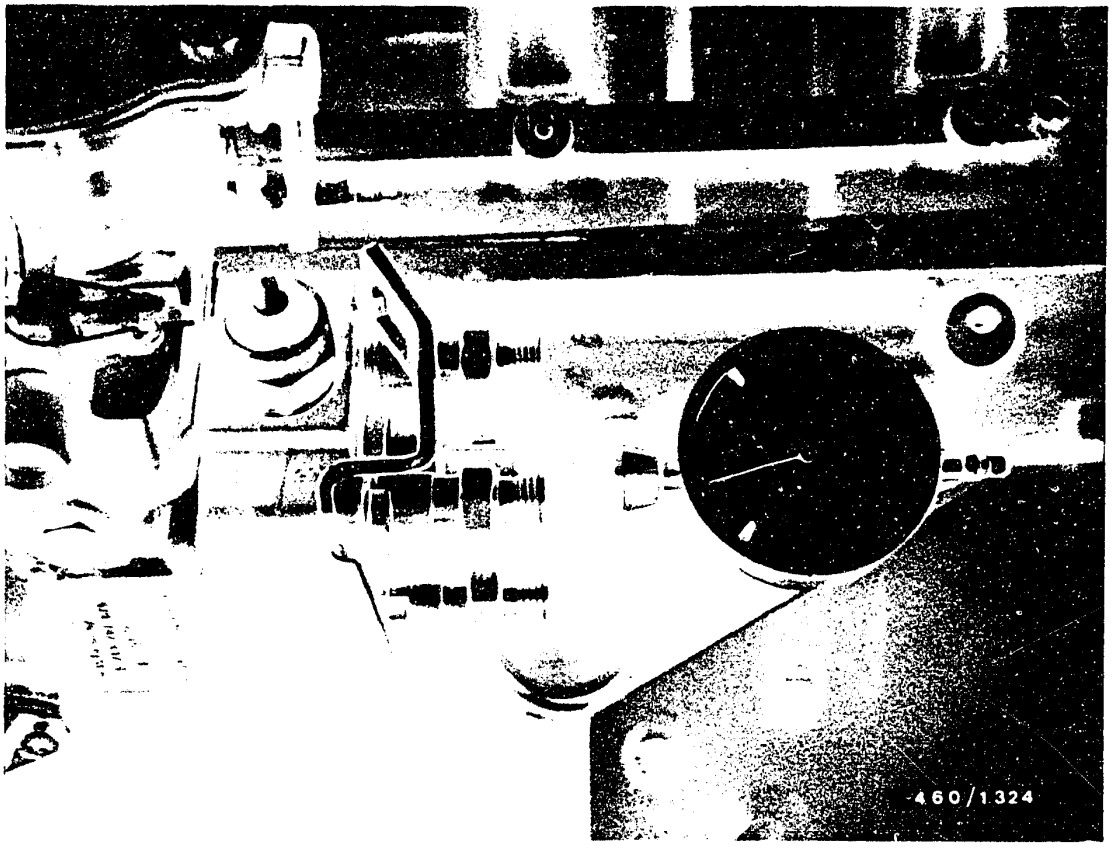
Tighten toothed-belt tensioner fastening screws (arrows).

Remove locating pins.

Turn engine crankshaft over twice in direction of rotation.

Loosen toothed-belt tensioner and re-tighten to 25 Nm.

Turn crankshaft in direction of rotation until TDC mark on clutch housing aligns with reference mark "PMS-1" on flywheel.



Remove injection lines from injection pump and nozzle holders. (Prevent delivery valves from coming loose by holding with a wrench).

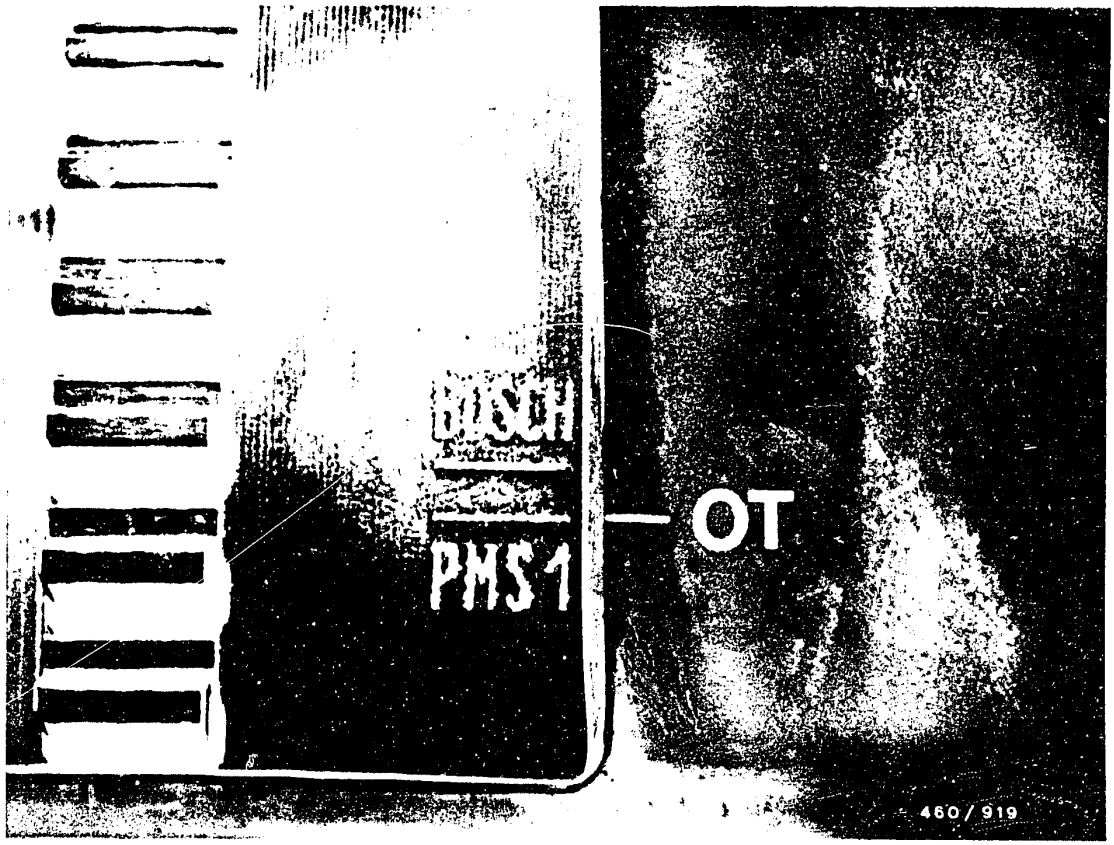
Unscrew the bleeder screw from the central screw plug (triangular-head plug) on the hydraulic head.

Mount measuring tool KDEP 1085 and the dial indicator in the threaded hole.

Preload the dial indicator by approx. 3 mm .

Slowly turn the crankshaft counter to the direction of engine rotation, until the needle on the dial indicator no longer moves.

Set the dial indicator at "0".



Turn crankshaft in direction of rotation until TDC mark on clutch housing aligns with reference mark "PMS-1" on flywheel (see picture).

In this position, the dial indicator must indicate a pump plunger stroke of 0.90 mm after BDC.

If a correction is necessary, loosen injection-pump fastening screws and pivot pump.

Tighten fastening screws to 25 Nm.

Turn crankshaft over twice and check adjustment again.

Remove measuring tool KDEP 1085 with dial indicator.

Mount bleeder screw with new seal ring.

Mount cylinder-head cover and toothed-belt protection cover.

Tighten injection lines with box wrench KDEP 1115. (Prevent delivery-valve holders from turning by holding with a wrench).

Bleed fuel system.

7. Check charge-air pressure

When working on the turbocharger, note that even minute particles of dirt may lead to the destruction of the turbocharger.
Therefore, never operate the engine without an air filter.

To check the charge-air pressure, it is possible to use pressure tester KDJE-P 100 or a pressure gauge 0 ... 16 bar (e.g. Wika No. 4184).

Measuring the charge-air pressure

The charge-air pressure is measured under full load, if possible on a chassis dynamometer.

Read off charge-air pressure on pressure gauge.

Set value: 0.87 bar

Note:

To evaluate the turbocharger, the following is essential: Engine at operating temperature, start of delivery and nozzle-opening pressure correctly adjusted, intake and exhaust sides not leaking, engine in good mechanical condition (valve clearance, compression pressure).

After installing a new turbocharger, fill turbocharger with oil and let engine idle for approx. 1 minute so that supply of oil to turbocharger is guaranteed.